BANGALORE WATER SUPPLYAND SEWERAGE BOARD
CAUVERY BHAVAN, KEMPEGOWDA ROAD,
BANGALORE – 560 009

Tender for the Work of Performance based Modernization, Remodeling of Water supply systems and reduction in UFW under Halasuru Service Station area limits of BWSSB, Bangalore.

Office of the Engineer -In-Chief
BANGALORE WATER SUPPLY & SEWERAGE BOARD
2nd Floor, Cauvery Bhavan, K. G. Road,
Bangalore -560009.

Telephone – 080-22945105
Telefax – 080-22945105
e-mail –eic@bwssb.gov.in
Website **www.kppp.karnataka.govt.in**

TENDER REFERENCE :	:	Work of Performance based Modernization, Remodeling of Water supply systems and reduction in UFW under Halasuru Service Station area limits of BWSSB, Bangalore. No.: BWSSB/EIC/ACE(NRW)/TA/AE/12729/2024-25 DATED: 04/03/2025	
PERIOD OF Download OF TENDER DOCUMENT	:	From: 06/03/2025	To: 20/03/2025
LAST DATE FOR Download OF TENDER DOCUMENT	:	20/03//2025 1600 hrs	
LAST DATE AND TIME FOR Submission / Uploading OF TENDERS	:	20/03//2025 1500 hrs	
TIME AND DATE OF OPENING OF TECHNICAL TENDERS	:	21/03//2025 1600 hrs	
PLACE OF OPENING OF TECHINCAL TENDERS	:	Office of the *Engineer-In-Chief* Bangalore Water Supply & Sewerage Board *2nd floor, Cauvery Bhavan* *K.G.Road, Bangalore -560009*	
TIME AND DATE OF OPENING OF PRICE TENDERS	:	Will be intimated to the Qualified Tenderers	
PLACE OF OPENING OF PRICE TENDER	:	Will be intimated to the Qualified Tenderers	
ADDRESS FOR COMMUNICATION	:	*Engineer-In-Chief* Bangalore Water Supply & Sewerage Board *2nd floor, Cauvery Bhavan* *K.G.Road, Bangalore -560009.*	

Contractor
Employer

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SECTION 1:

BANGALORE WATER SUPPLY AND SEWERAGE BOARD
Office of The Engineer-In-Chief
2nd Floor, Cauvery Bhavan D Block,
K.G.Road, Bangalore 560009
Website **www.kppp.karnataka.govt.in**

Tel Fax: 080-22945105
Telephone: 080- 22945105

INVITATION FOR SHORT TERM TENDER (IFT)
(Through KPP-Procurement Portal Only)

IFT No.: BWSSB/EIC/ACE(NRW)/ 12728/2024-25 Dt: 04-03-2025

1. The Engineer-In-Chief invites tender from eligible tenderers, for the construction of work detailed in the Table below through e-PROCUREMENT process with two stages tender procedure in line with the Rule28 of the KTPP Act. The details regarding their qualification to take the tender (as detailed in ITT Clause 4) and the price tender shall be uploaded in the website of the e-procurement wizard. Technical details will be opened on the date and time mentioned in IFT clause 5 and evaluated. The price tender of the Tenderer, who is found to be qualified to execute the tendered works, will be opened on the date notified later. The Tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to Tenderers (ITT) to qualify for award of the contract.
2. Tender documents may be downloaded through the e-procurement wizard which will link to **www.kppp.karnataka.govt.in from 06/03/2025 to 20/03/2025,** on payment of a non-refundable fee indicated in the Table below, using any of these forms of OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only**.** Interested tenderers may obtain further information at the Office of e-procurement. Tenderers will be issued a password and authorized for accessing the tender document in the website with URL: **www.kppp.karnataka.govt.in**
3. The Bidders can download the e-tender document using their user ID – password, by accessing **www.kppp.karnataka.govt.in** where electronic tender form is provided. Additional information related to e-tender process can be obtained through the above mentioned website. The electronic tender will be operated as Two stage Tender system by opening the Technical details first and financial portion of the eligible tenderers later.
4. Tenders must furnish Earnest Money Deposit specified for the work in the Table below. Earnest Money Deposit will have to be paid through any one of the forms OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

Sl. No	**Name of Work**	**Cost of Tender Document including Taxes Rs.**	**Amount put to Tender Rs. in Lakh (Approx) (excluding GST)**	**Bid Security Rs. in Lakh**	**Period of completion**	**Eligibility Criteria during last 5 years (2019-20, 2020-21, 2021-22, 2022-23 & 2023-24)**	
						Turnover (in all classes of Civil Engineering construction works) for any of the two financial years Rs. in Lakhs	**Performance & Work Qualification**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Work of Performance based Modernization, Remodeling of Water supply systems and reduction in UFW under Halasuru Service Station area limits of BWSSB, Bangalore.	To be specified by e-procurement cell.	**3132.52**	**31.33**	**24** months (Including monsoon period)	**3696.37**	i. As prime contractor Should have satisfactorily completed, at least one similar work of ***Water Supply Pipeline under improvement to distribution Network pr***oject only of value not less than **Rs. 1848.19 lakhs** ii) As prime contractor should have executed in any one financial year the following

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							minimum quantities of work: (a) Providing, laying, testing and Commissioning of DI pipeline from 100mm and above-**42,000 rmt** completed in all respect. (b) Supply, laying, jointing, Testing and commissioning of service connections making bore holes for fix house service connections including road cutting, excavation, backfilling, disposal and road restoration-**7200 Nos**. completed in all respect. (c) Supply, installation &commissioning of EMF Bulk Flow meters from 100mm and above- **9 Nos** completed in all respect. (d) Providing and laying of RCC/PCC Concrete minimum M15 grade -**3500 cum**

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							completed in all respect (e) Earthwork excavation in all strata- **35,200 Cum** completed in all respect iii. As a prime contractor Should have satisfactorily completed, commissioned & issuance of completion certificate in DMA concept for minimum **14 nos** of DMAs in water supply network

5. The last date for uploading of completed tender document is on **20/ 03/2025** up to **16:00 hrs.**

6. The bids will be opened at the office mentioned in para no.12 on **21/03/2025** at **16.00 hrs** in the presence of bidders or their authorized representatives. If the bid opening day remains as public holiday, Bids will be opened on the next working day at the original stipulated time.

7. Bidders can access tender documents from the website and upload the required details; those are mentioned in different sections in the bid document in to electronic tender box on the website. Scanned documents those are required to be furnished as per Section 2, 3 & 4 of the bid document shall be submitted through e-portal preferably in **PDF** format for clear vision.

8. The cost of the tender document once paid will not be refunded.

9. The successful bidder would be required to give performance **bank guarantee of 5%** of the contract amount plus additional security for unbalanced bid amount from a Nationalized / Scheduled Indian Bank, with jurisdiction at Bangalore as specified in the clause no.29 of ITT, towards guarantee for completion of work within the stipulated period.

10. Bangalore Water Supply and Sewerage Board reserve the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reason.

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11. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours 10:30hours to 17:00 hours.

Engineer-In-Chief,
Bangalore Water Supply and Sewerage Board
2nd Floor, Cauvery Bhavan D- Block,
Kempe Gowda Road, Bangalore - 560009
Karnataka, India.
Tel Fax: -91-80-22945105
Telephone: +91-80- 22945105
e-mail ID : eic@bwssb.gov.in
Or **visit Website www.kppp.karnataka.govt.in**

12. List of documents to support qualification of bidder is to be uploaded to the e-Portal website **www.kppp.karnataka.govt.in**

13. Bidders shall submit offers that comply with the requirements of the bid document, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered. The attention of the bidders is drawn to clause 23 regarding the rejection of the bids, which are not substantially responsive to the requirement of the bid document.

14. To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the Tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts as per Clause 3.

15. Other details can be read from the tender documents.

16. Contractors should have registration in KPWD of State Government organization, public sector under takings, other state Governments and the documentary evidence towards the same shall be furnished.

-Sd-
Engineer-In-Chief
BWSSB

SECTION 2:

INSTRUCTIONS TO TENDERERS (ITT)

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A. General

1. Scope of Tender

1.1 The Engineer-In-Chief**,** (Referred to as Employer in these documents) invites tenders following Two Cover e-Procurement procedure, from eligible Tenderers, for the construction of work (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are acceptable.

3. Qualification of the Tenderer:

3.1 All Tenderers shall provide the requested information accurately and in sufficient
detail in Section 3: Qualification information.

3.2 To qualify for award of this contract, each Tenderer in its name should have in
the last five years i.e. 2019-20 to 2023-24).

(a). achieved in at least two financial years a minimum financial turnover (in
all classes of civil engineering construction works only) of Rs**.3696.37**
lakhs.

(b). As prime contractor Should have satisfactorily completed, at least one similar
work of Water Supply Pipeline under improvement to distribution
Network project only of value not less than **Rs. 1848.19 lakhs**

(c). Executed in any one year, the following minimum quantities of work:

i. Providing, laying, testing and Commissioning of DI from 100mm and above – **42000 rmt** completed in all respect.

ii. Supply, laying, jointing, Testing and commissioning of service connections making bore holes for fix house service connections including road cutting, excavation, backfilling, disposal and road restoration- **7200 Nos**. completed in all respect

iii. Supply, installation & commissioning of EMF Bulk Flow meters from 100mm and above- **9** Nos completed in all respect.

iv. Providing and laying of RCC/PCC Concrete minimum M15 grade -**3500** cum completed in all respect

v. Earthwork excavation in all strata-**35200** Cum completed in all respect

d) As a prime contractor Should have satisfactorily completed, commissioned & issuance of completion certificate in DMA concept for minimum **14** nos of DMAs in water supply network

0 3.3. Each Tenderer should further demonstrate:
1

(a) Availability by owning/ deployed on lease / hire basis for all works provided, the relevant documents (commitment agreements etc.,) for availability for this work shall be furnished. Some of the equipment's are:

2 Some of the equipment's are:

(i)	Concrete/Asphalt Bracker/cutting machine	-	4 no.
(ii)	De watering pumps	-	6 No
(iii)	Excavators	-	6 No
(iv)	Compressors	-	2 no
(v)	Tractors	-	2 no
(vi)	Hydraulic testing machine	-	4 no

(b) liquid assets and /or availability of credit facilities of no less than ***Rs.924.1 lakhs*** (Credit lines/ letter of credit/ certificates from banks for meeting the fund requirement etc.

3.4 To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the Tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts.

3.5 Sub-contractors experience and resources shall not be taken into account in determining the Tenderers compliance with the qualifying criteria except to the extent stated in 3.2 (d) and (e) above.

1 3.6 Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B) Should not be less than **Rs. 3696.37** Lakh

where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to **2023-24** price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited.

B = Value, at **2023-24** price level, of existing commitments and on-going works to be completed during the next **2** years (period of completion of the works for which Tenders are invited) *

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.

3.7 Even though the Tenderers meet the above criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

Joint Ventures

Deleted

4. One Tender per Tenderer: (Deleted)

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible and liable for those costs.

6. Site visit:

6.1 The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tenderers own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2:

7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or e-mail only at the Employer's address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer's response will be forwarded to all purchasers of the tender documents through e-mail, including a description of the enquiry but without identifying its source. Same will available in the website of e-procurement www.karnataka public procurement portal

8.2 Pre-tender meeting:

8.2.1 Deleted.

8.2.2 Deleted.

8.2.3 Deleted.

8.2.4 Deleted.

8.2.5 Deleted.

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1 The tender submitted in e-procurement by the Tenderer shall contain the documents as follows:

(a) Evidence of Earnest Money Deposit payment;
(b) Scanned copies of Qualification Information as per formats given in Section 3;
(c) The form of Tender (in the format indicated in Section 4) duly signed
(d) Priced Bill of Quantities (Section 9);
and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception. The Earnest Money Deposit shall be submitted to the Tender inviting authority on or before the time of submission mentioned in IFT. ALL THE PHOTOCOPIES OF THE DOCUEMNTS SHOULD BE NOTARISED.

10.2 Tenderers submitting tenders together with other contracts stated in the IFT to form a package will so indicate in the tender together with any discounts offered for the award of more than one contract.

11. Tender prices

11.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

11.2 The bidder shall fill in the unit rates in figures for all items of the Works described in the Bill of Quantities. The system will

automatically convert the unit rates mentioned in figures to words and also calculate the amount of that item as well as the total Bid value. *Items for which no rate is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates in the Bill of Quantities*

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer. The tender should take care of applicable Taxes and Duties at the time of bidding and rates quoted should be inclusive of all.

11.4 Amount Put to Tender is excluding GST.

Note: *"Bidders may like to ascertain the availability of excise/custom duty exemption benefits available in India to the contracts for Water Supply. They are solely responsible for obtaining such benefits which they have considered in their bid and in case of failure to receive such benefits for reasons whatsoever, the employer will not compensate the bidder (contractor). Where the bidder has quoted taking into account such benefits, he must give all information required. To the extent the employer determines the quantity indicated therein are reasonable keeping in view the bill of quantities, construction programme and methodology, the certificates will be issued within 60 [sixty] days of signing of contract and no subsequent changes will be permitted. No certificate will be issued for items where no quantity/capacity of equipment is indicated in the BOQ. Any delay in procurement of the construction equipment /machinery/goods as a result of the above shall not be a cause for granting any extension of time."*

11.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 40 of the Conditions of Contract for the contracts with period of completion is more than 12 months.

12. Tender validity

12.1 Tenders shall remain valid for a period not less than **ninety days** after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers responses shall be made in writing

or by cable or e-mail. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 13 in all respects.

13. Earnest money deposit

13.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 4 of the Table of IFT for this particular work. EMD can be paid through OTC, NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender.

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or
(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
    (i) sign the Agreement; or
    (ii) furnish the required Security deposit

14. Format and signing of Tender

14.1 The completed bid comprising of documents indicated in ITB 12, should be uploaded in the e-procurement wizard of Government of Karnataka through “e-portal” along with scanned copies of requisite certificates those are mentioned in different sections in the bid document and EMD can be paid through OTC, NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

14.2 All the documents should be uploaded to the e-procurement wizard of GOK. Tenderer should take a print out of the declaration letters provided in the website on company letter head and should sign, stamp and upload the same to the e-procurement wizard.

14.3 Deleted

D. Submission of Tenders

15. Up-loading & submission of tenders

15.1 The tenders should be uploaded only through e-portal system. Tender should contain

A. Technical Tender consisting of following:

a. All the documents with required details in prescribed format; those are mentioned in different sections in the Tender. Form of Tender, Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2, etc., shall be downloaded, filled with required details, signed, scanned & uploaded to the e-procurement website **www.kppp.karnataka.govt.in** on or before the time and date indicated in notification /Section I IFT.

b. **Tender security.** Tender security can be paid in the form of OTC,NEFT,DEBIT CARD,CREDIT CARD in e-procurement of Govt. of Karnataka.

The above documents along with notarized copies of documentary evidences as indicated in Section—II ITT, Section-III Qualification information & Section IV Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete bid document and

B. Financial Tender consisting of Bill of Quantities (file name: BOQ.xls). The tenderer shall down load the bill of quantities and key in the rates (in figures only) in the Bill of Quantities sheet and upload the same file on to the website on or before the time and date indicated in notification /Section I IFT.

In case of failure of the tenderer to upload the same within stipulated time ie., **Dated:- / /2025**, their tender will be rejected.

NOTE:

1. URL of the Website for tender submission through e-Procurement & Address for uploading of Tender security are as follows:

i **www.kppp.karnataka.govt.in.**

ii The Engineer-In-Chief, BWSSB, II floor, Cauvery Bhavan, KG Road, Bangalore - 560009
Tel Fax; +91-80-22945105, Telephone: +91-80-22945105

2. The details related to submission of tenders, downloading / uploading of documents or other details are available online in the help wizard, Vendor manual & FAQ of above

website. The same is provided along with sample formats in Annexure-I of the Bid document for ready reference.

15.2 Deleted

15.3 Unique Identification Number will be automatically generated by the server with time -stamp and sent to the account of the bidder as an acknowledgement after bidder finally uploads the bids.

15.4 Deleted

16. Deadline for submission of the Tenders

16.1 tenders should be uploaded only through e-portal system no later than **20/03/2025**. In the event of the specified date for the submission of tenders being declared a holiday for the Employer, the tenders will be received up to the appointed time on the next working day.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Clause 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 The software of e-procurement system will not allow the Bidder to upload the documents after expiration of the stipulated date & time of Bid submission. The Bidder shall refer the server time, which will be displayed in the e-procurement portal. Employer will not be responsible for non-receipt of bids on the stipulated date & time prescribed in clause 16, due to Internet Problems, improper uploading or any other related problems. In case of connectivity problems, Tenderer may contact Helpdesk of the e-tender service provider and may also draw the attention of tender inviting authority.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may “modify” and “withdraw” their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in e-tendering. If the Tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 16. In this case within the stipulated date & time, the tenderer can once again submit the requisition to the officer inviting tenders for access to the withdrawn tender document for resubmission. For this tenderer need not

make any additional payment towards the cost of tender document. Communication of modification / withdrawal by other means will not be accepted.

18.2 Deleted.

18.3 No Tender may be modified after the deadline for submission of Tenders.

18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the forfeiture of the earnest money deposit pursuant to Clause 13.

18.5 Tenderers may offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. Tender opening and evaluation

19. Opening of Technical portion of Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open the Technical details of all the Tenders received (except those withdrawn), including modifications made pursuant to Clause 18, in the presence of the Tenderers or their representatives who choose to attend **at 16.00 hours on / /2025** in the office of Engineer-In-Chief, 2nd Floor, Cauvery Bhavan 'D' Block, K.G. Road, Bangalore 560 009. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

19.2 WITHDRAWAL proposal submitted pursuant to clause 18 shall be read out first and their bids shall not be opened.

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3.

19.5 The Price Tenders of all the Tenderers including modifications for Financial tenders can not be opened as this is programmed to open later after evaluation of the Technical details of the participating Tenderers.

19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Second Cover of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the price Tenders. The Employer will open the price tender of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Price tender opening being declared a holiday for the Employer, the price tenders will be opened at the appointed time and location on the next working day.

20.2 Deleted.

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender opening.

20.4 The Employer shall prepare minutes of the Price Tender opening, including the information disclosed to those present in accordance with Sub-Clause 20.3.

21. Process to be confidential

21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22. Clarifications of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer's Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers' Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents like [(a)Form of Tender, (b)Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2 etc.,] Scanned / uploaded [including documents those are required to be furnished as per Section 2, 3 & 4 of the tender,]; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the tendering documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

24.1 (a) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, rate in words will be auto generated by the system.

(b) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, the system will automatically calculate the amount of that item as well as the total Bid value.

24.2 Deleted

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

(a) making any correction for errors pursuant to Clause 24; and

(b) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 18.5.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract. :

1 - A bank guarantee in the form given in Section 10 in favor of ***Chairman, BWSSB*** payable at ***Bangalore***;

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank.

29.3 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30 Advance Payment and Security:

30.1 The Employer will provide an advance payment on the contract price as stipulated in the Conditions of Contract, subject to the maximum amount as stated in the Contract Data.

31. Corrupt or Fraudulent practices

31.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK :

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

SECTION 3:

QUALIFICATION INFORMATION

QUALIFICATION INFORMATION

The following form is to be downloaded, particulars are to be filled, scanned & uploaded by the Bidder, to the e-procurement of Government of Karnataka wizard **"www.kppp.karnataka.govt.in"** along with the Bid.

Note: The detailed procedure for downloading / uploading the documents will be available in Help wizard, Vendor manual & FAQ of the above-mentioned Website.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy]
Place of Registration _____
(Attach Copy)

Principal place of business: _____

1.2 Total value of civil engineering construction works executed and payments received in the last five years (in Rs. Lakhs)

2019 - 20 _____
2020 – 21 _____
2021 – 22 _____
2022 – 23 _____
2023 – 24 _____

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of contract Rs. Lakhs	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of Work	Name of Employer	Quantity of work performed (cum)			Remarks (Indicate contract reference)
			Reinforc	Masonr	Earthwork	

Contractor
Employer

			ed Cement Concrete	y	s	
2019-20						
2020-21						
2021-22						
2022-23						
2023-24						

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place& State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. lakhs)	Stipulated period of completion	Value of works remaining to be completed (Rs. lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. lakhs)	Stipulated Date period of completion	when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6. The following items of equipment are considered essential for successfully carrying out the works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement			Owned and available		Remarks
	No.	Capacity	Owned	Number/ Capacity	Age/ Condition	

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor’s reports for the last five years;

1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

ISSUED IN THE LETTER HEAD OF THE BANK BRANCH]

Reference Number (Sl No.) Place
Date
To
(Name & Address of the beneficiary)

This is to certify that Mr./ M/s. ..... [name of the customer] having is /their registered/administrative office at.....is a customer of our bank and are engaged in..... (nature of activity). If the .....customer is allotted/awarded with ..... (brief details of works], we may extend credit facilities upto Rs..... lakh, to meet his /their working capital requirement towards the execution of the said work order as per Loan policy of the Bank.

This credit is valid upto three months from the date of issue, that is upto dd/mm/yyyy.

Sd/-
Name of the Bank, Branch
Manger
Address:
.....

1.11 Proposals for subcontracting components of works amounting to more than 20% of the contract price .

Item of Work	Value of Sub-Contract	Identified Sub-Contractor (Name and address)	Experience of similar work

Contractor
Employer

1.12 Information on litigations in which the Tenderer is involved:

Other Party (ies)	Employer	Details of dispute	Amount involved	Remarks showing present status

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

Contractor
Employer

SECTION 4:

FORMS OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works: **Work of Performance based Modernization, Remodeling of Water supply systems and reduction in UFW under Halasuru Service Station area limits of BWSSB, Bangalore.**

Tender

To
Engineer-In-Chief
Bangalore Water Supply & Sewerage Board
2nd floor, Cauvery Bhavan
K.G.Road, Bangalore -560009

GENTLEMEN,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price uploaded for this tender to be opened after qualification.

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

The advance payment required is Rs……

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory:
_____
Name of Tenderer _____
Address: ----------

NOTE: This form shall be download, filled and printed on the Company letter head, Signed, Scanned and uploaded. Failure to furnish the signed copy will lead to Non-Responsive Tender. The disclosure of financial bid in technical bid, will be treated as technically non-responsive.

Letter of Acceptance
(letterhead paper of the Employer) _____[date]

To: _____[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the _____ _____ [name of the contract and identification number, as given in the Instructions to Tenderers] for the Contract Price of Rupees —— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.———— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ..... and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of Agency

Issue of Notice to proceed with the work
(letterhead of the Employer)
———— (date)
To
————————————— (name and address of the Contractor)
—————————————
—————————————
Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of ————[name of the contract] a Tender Price of Rs. ————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form

Agreement

This agreement, made the _____day of _____20_____, between_____
_____[name and address of Employer] (hereinafter called "the Employer") of the one part and _____ _____
_____
_____ __ _____[name and address of contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute _____
_____
_____
_____[name and identification number of Contract] (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   i) Letter of Acceptance;
   ii) Notice to proceed with the works;
   iii) Contractor's Tender;
   iv) Contract Data;
   v) Conditions of contract (including Special Conditions of Contract);
   vi) Specifications;
   vii) Drawings;
   viii) Bill of Quantities; and
   ix) Any other document listed in the Contract Data as forming part of the contract.

5. Jurisdiction of Courts/Arbitration: The sitting of arbitration shall be held at Bangalore only and nowhere else.

Contractor
Employer

6. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore City only and the parties agree and clearly understand that the courts/tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place.

7. The Parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the contract at Bangalore.

8. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place or conditions during the execution of the contract.

9. Contractor shall be fully responsible in the event of death of employee/workman during the execution of the work and liable to pay adequate compensation to the dependents of employee/workman as per law.

10. On his/their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.

11. If death of any employees occurs during execution of work due to negligence of contractor, the contract will be liable for termination.

12. In the event of such termination, the employer may consider blacklisting of firm after due notice.

13. In case of any death or accident the contract will be cancelled after following due process.

14. The Board will be entitled to claim exemplary damages from the contractor in case of death of any work man / employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.

15. Road cutting machine should be used mandatorily while executing the work.

16. Any utilities encountered during execution if damaged by the contractor, the same need to be rectified immediately without any delay at his own cost with due approval from the concerned.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said _____

Contractor
Employer

_____
___

in the presence of:

Binding Signature of Employer

_____

Binding Signature of Contractor

_____

Contractor
Employer

SECTION 5:

CONDITIONS OF CONTRACT

Contractor
Employer

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Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

A **Variation** is an instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor’s Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor .

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 Deleted

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the design of the Works, other than the Contractor's design; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or
(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;
(A) prevent loss or damage to physical property from occurring by taking appropriate measures or
(B) insure against such loss or damage

12. Contractor's risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances, in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data :
(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;
(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and
(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payments is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of an insurance shall not be made without the approval of the Employer.

13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:

14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data

15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works

16.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer:

18.1 The Contractor shall submit Specification and drawings showing the proposed Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the design of Temporary Works

18.3 The Employer’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of third parties to the design of the temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 If the Contractor is not satisfied with the decision taken by the Employer, the dispute shall be referred by either party to Arbitration within 30 days of the notification of the Employer’s decision.

24.2 If neither party refers the dispute to Arbitration within the above 30 days, the Employer’s decision will be final and binding.

24.3 The Arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

29.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer’s notice.

32. Uncorrected defects

32.1 If the Contractor has not corrected a Defect within the time specified in the Employer’s notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

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Contractor
Employer

3 D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him

(a) Increase or decrease of any item of work included in the Bill of Quantities (BOQ);
(b) Omit any item of work;
(c) Change the character or quality or kind of any item of work;
(d) Change the levels, lines, positions and dimensions of any part of the work;
(e) Execute additional items of work of any kind necessary for the completion of the works; and
(f) Change in any specified sequence, methods or timing of construction of any part of the work.

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and the officer issuing oral instructions shall confirm it in writing with in 30days, failing which the work shall be carried out as though there is no variation. In case variation is approved, it shall be accompanied by BOQ, failing which the contractor shall be responsible for deviation, if any. Further, approval of the Board has to be obtained for the variation exceeding 5%.

35. Payments for Variations

35.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

35.2 For quantities in excess of 125% of the tendered quantity of an item as given in the BOQ, the Contractor shall be paid at the rate entered

in or derived from in the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

35.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rate for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract

35.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 35.1 or 35.2 or 35.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

1 35.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer’s own forecast of the effects of the Variation on the Contractor's costs.

35.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

35.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor within 45 days of submission of bill. The Contractor shall be liable to pay liquidated damages for shortfall in progress. For Progress beyond the agreed programme, payment is subject to availability of the grants.

37.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.
(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
(e) The effect on the Contractor of any of the Employer's Risks.
(f) The Employer unreasonably delays issuing a Certificate of Completion.
(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

40. Price Adjustment:

40.1 Contract price shall be adjusted for increase or decrease in rates and prices of materials, fuels and lubricants in accordance with the following principles and procedures and as per formulae given in the Contract Data.

1 (a) The price Adjustment shall apply for the work done from the date of commencement up to the end of original period of completion or extensions granted by the Employer and shall not apply to work carried out beyond the stipulated period of completion for reasons attributable to the Contractor;

2 (b) Price Adjustment shall be admissible from the date of opening of tenders (original or extended)

3 (c) The price adjustment shall be determined during each quarter from the formulae given in Contract Data.

4 (d) Following expressions and meanings are assigned to the work done during the quarter:

R = Total value of work done during the quarter. It will exclude value for works executed under variations for which price adjustment (if any) will be worked out separately based on the terms mutually agreed.

40.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 The Employer shall make payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an unconditional bank guarantee in a form acceptable to the Employer issued by a Nationalized/Scheduled Bank in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

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42.2 The Contractor is to use the advance payment only to pay for Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Employer.

42.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuation of the work done, variations, price adjustments, compensation events or liquidated damages.

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

44.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the

Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

49.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer;

(b) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(c) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

(d) the Contractor does not maintain a security which is required;

(e) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(f) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph : "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause

49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

51.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor’s default.

52. Release from performance

52.1 If the Contract is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made

F. Special Conditions of Contract

1. Labour :

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labour regulations :

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be

passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

Salient features of some of the major laws that are applicable are given below:

The Water (Prevention and Control of Pollution) Act, 1974, this provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

The Air (Prevention and Control of Pollution) Act, 1981, this provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

The Environment (Protection) Act, 1986, this provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.

The Public Liability Insurance Act, 1991, this provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

4. Arbitration (Clause 24)

4.1 arbitration shall be deleted

(a) In case of dispute or difference arising between the Employer DAB shall be constituted comprising of BWSSB representative, contractor representative & 3rd party.

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 The Contractor has to co-ordinate with the other concerned Contractors as already specified in Conditions of Contract for all such works as per the directions of Engineer in charge at no extra cost.

6 **Continuation of Work:**

6.1 In case of the depth of a contractor after executing the agreement / commencement of the work, his legal heir, if any eligible registered contractor and willing, can execute and complete the work at the accepted tender rates irrespective of the cost of the work

7. Third Party Inspection and Testing:

The Employer will engage a PMC for inspection at manufacturer's works and also the work site activities. The items for Third Party Inspection and the stages of Inspection are given in. The list is illustrative and not exhaustive.

8. Procurement of materials and equipment:

The Contractor shall procure and use ISI marked materials and equipment or those conforming to relevant Bureau of Indian Standards **or any applicable standards. The Contractor shall obtain approval to the drawings and the Quality Assurance Plan (QAP) of the materials to be used in the project by the competent authority before execution.**

The objective of the specifications given in this section is to specify the details pertaining to the design, drawing, and selection of equipment or product. The equipment or product supplied shall be of high standard of quality and best engineering practices and shall comply with all currently applicable standards, regulations and codes. Except as otherwise specified in this technical specification, the

Indian/International Standards and Codes of Practice in their latest version shall be adhered to for the design, manufacturing, inspection, calibration, installation, field testing, packing, handling and transportation of product. Should any product be offered conforming to other standards, the equipment or products shall be equal to or superior to those specified and the documentary confirmation shall be submitted for the prior approval of the employer.

09. FURTHER THE FOLLOWING CONDITIONS WILL ALSO BECOME PART OF THE AGREEMENT WHICH MAY PLEASE BE NOTED.

a) Rates quoted by the contractor / firm should be excluding GST.
b) The contractor / firm should mandatorily pay by themselves the necessary Entry Tax & other applicable taxes without fail.
c) Materials purchased with regards to work contract, the Board will not issue e-Sugam numbers.
d) Any lawful exemptions or tax benefits available under these projects shall be transferred to the employer.
e) The Bidder Should not have applied for or are now part of Corporate Debt Restructure (CDR) in the last 5 Financial Years.
f) The Contractor shall use tertiary treated water from BWSSB wherever available for Construction, Hydro testing at the prevailing rates of BWSSB.
g) The Supply of pipes and other materials shall be initially for only 50% of the quantity of BOQ is considered and further supply will be as per the recommendations of the Engineer In-charge based on the requirement.
h) All required permissions/ROW issues from all concerned departments shall be obtained from the contractor and Board Engineers will assist for the same. The necessary statutory charges to be paid will be remitted by BWSSB on obtaining the demand note from concerned departments.
i) No Variation work will be executed by the firm unless approval is conveyed from the Competent Authority.
j) The Hard Rock obtained during execution, will not be auctioned by Board (Because of the restriction in stacking of hard rock in site and safety issues). However, the rate per cum of Hard Rock will be considered at the recently approved auction at BWSSB and recovered in the running bills.
k) One designated qualified safety officer/Engineer shall be deployed at site from the firm.
l) The Bulk flow meters are provided for formation of DMAs.

Road Restoration work, will be carried out by Contractor as per relevant IRC specifications & IS in accordance with the BOQ.

m) The contractor is being informed that, Government of India have introduced GST taxation. From 1st July 2025. GST has been introduced. APT is excluding GST. Accordingly, the taxes to be

considered and to be quoted in the bid. Any abolition of Excise Duty exemption, the same should be considered while quoting.

n) The firm has to provide one new laptop, A3 printer at the designated officer office of the BWSSB for project purpose at no cost to BWSSB. The same are to be maintained until the end of contract period and to be handed over to BWSSB.

(o)Adjustments for Changes in Legislation
The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date.

The Contractor shall give notice to the Employer and shall be entitled to payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Employer shall proceed to agree or determine these matters.

1. Progress Reports:

Monthly progress reports shall be prepared by the Contractor and submitted to the Employer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted thereafter each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking Over Certificate for the Works.

Each Report should include:

(a) Charts and detailed descriptions of progress, including each stage of design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trail operation;
(b) Photographs showing the status of manufacture and of progress at the Site;
(c) For the manufacture of main items of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual and expected dates of:
    (i) Commencement of manufacture;
    (ii) Contractor's inspections;
    (iii) Tests; and
    (iv) Shipment and arrival at the Site;

(d) Details of Contractor's personnel and equipment;
(e) Copies of quality assurance documents;

(f) List of variations, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

(g) Comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays;

12. In respect of Conditions of Contract of Section-C-Quality Control, Clause.35 of 35.1 under Payments for Variations for upto 125% of BOQ- The BOQ rates is compared with SR of year of award plus TP rates and lesser among them is considered for quantities exceeding 125% of BOQ in the work slip.

13. As per Conditions of Contract under Clause-18 of Approval by the Employer- The contractor has to carry out the survey, Geo technical investigation and submit the drawing related water supply pipeline. After the verification and concurrence of the PMC, Contractor has to submit 6 sets of drawings for approval. The distribution of drawings by the employer as below:

PMC- 1set.
Employer-4 Sets
Contractor- 1set.

14. As this is a performance based contract, the contractor should maintain the average UFW level of 10% in the DMAs formed in the project area throughout the DLP.

15. Inlet, outlet along with consumption should be monitored.

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Employer

Annexure: Not Applicable

LIST OF ORGANIZATIONS WHO ARE CONSIDERED AS APPOINTING AUTHORITY FOR APPOINTMENT OF ARBITRATORS

1	1. Indian Council of Arbitration, New Delhi;
2	2. International Centre for Alternative Disputes Resolution (India);
3	3. Indian Roads Congress;
4	4. Indian Building Congress;
5	5. Indian Institute of Bridge Engineers;
6	6. Indian Institute of Public Health Engineers;
7	7. Institute of Water Works

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Contractor
Employer

SECTION 6:

CONTRACT DATA

CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract: Clause Reference

1 • The Schedule of Operating and Maintenance Manuals [48]
2
3 • The Methodology and Program of Construction [25]
4
5 • Site Investigation Reports [14]
6
7 • The Schedule of Key and Critical Equipment to be deployed on the work as per agreed program of construction. [25]

The Employer is : **Bangalore Water Supply & Sewerage Board**
Name: *Represented by Engineer-In-Chief* [1.1]

Address: **Bangalore Water Supply & Sewerage Board**
2nd floor, Cauvery Bhavan
K.G.Road, Bangalore -560009

Name of authorized Representative: **Executive Engineer UFW-2 BWSSB**
Suvarna Bhavan, BWSSB, Bangalore

The name and identification number of the Contract is : **Work of Performance based Modernization, Remodeling of Water supply systems and reduction in UFW under Halasuru Service Station area limits of BWSSB, Bangalore.**

The Works involves Survey, Designing of DMA, fixing of Bulk Flow meters, survey of unauthorized connections, earth work excavation, providing and laying water supply pipeline including specials, fixing of valves, construction of Valve Chambers, fixing of AZP, CPP, arresting of leaks, reduction of UFW activity, plugging contamination etc.,

The start date shall be the date of issue of notice to proceed with the work. [1.1]

The Intended Completion Date for the whole of the Works is ***24 Months*** with the following milestones [17, 26]
Milestone dates: [41]

Mile stone No.	**Period from date of commencement as per tender**	**PARAMETERS**	**FINAL TARGET**	**Cost of Milestone in Rs.**
1	6 months	Complete topographical survey of network area, Network modeling of DMA's of the Project boundary including, Pressure Zero Test & Confirmation of hydraulic discretion to ascertain the number of DMAs within project boundary. 50% of pipeline procurement	If Target for 6 months is not achieved 5% of the cost of Milestone in the contract will be withheld and will be released after achieving the target.	2253000
2	12 months	75% of pipeline procurement. laying of 50% of the pipeline quantity to be completed along HSC. 25% DMA formation	If Target for 12 months is not achieved 5% of the cost of Milestone in the contract will be withheld and will be released after achieving the target.	4031000
3	18 months	100% of pipeline procurement. laying of 70% of the pipeline quantity to be completed along HSC. 75% DMA formation	If Target for 18 months is not achieved 5% of the cost of Milestone in the contract will be withheld and will be released after achieving the target.	2564700
4	24 Month	a).Complete pipe line along with HSC to be completed and commissioning and delinking of the existing network in complete manner	If DMA wise target level of 10% is not achieved then 5% of the completed work cost in the DMA will be withheld and will be released after achieving the target.	
		b). By the end of 24 months in ALL DMA's UFW should be reduced to 10%.		
5	Defects Liability period (365 days) after issue of taking over	An average UFW in the project area should be maintained at 10% during this period.	If target is not achieved 5% of the contract value will be recovered	

Contractor
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	certificate.		from the Contractor.	

*The Contract value has to be evaluated and to be included at the time of Agreement.

Note: To aim the project output and to ensure targeted 10% UFW in the proposed project area an amount of Rs. 12.32 lakh from 1st RA bill till 15th RA bill will held up or equivalent BG shall be furnished at the time of contract signing and the same will be released after completion of DLP.

The Site Possession Date is: 15 days [21]
The Site is located in Halasuru Service Station area limits of BWSSB, Core area of Bangalore and is defined in drawings. [1.1]

Payment Terms.

The employer will make the payment to the items of pipelines on the following terms

For DI Pipelines

70% of the contract price	After supply of DI pipes to site of work
20% of the contract price	After laying of DI pipes.
10% of the contract price	After certification of Hydraulic testing of DI Pipeline commissioning of DI Pipeline work including delinking and road restoration.

Valves, Air-Valves.

70% of the contract price	After supply of Valves to site of work
20% of the contract price	After fixing in pipeline.
10% of the contract price	After successful completion and commissioning of work

For all specials, 80% of the payment will be made only after supplying, laying, fixing at site and balance 20% after commissioning & delinking

For Bulk Flow Meters, 60% of the payment will be made after supplying, 20% after fixing at site and balance 20% after commissioning (For Bulk Flow Meter and AMR meters, commissioning includes transfer of DATA to Central SCADA/D2b SCADA System).

The Defects Liability Period is **365**days [31]

Contractor
Employer

Insurance requirements are as under: [13]

Type of Cover		Minimum Cover for Insurance
(i)	Works and of Plant and materials	The sum stated in the Agreement plus 20%
(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party (b) Board Engineers	Rs. 20.00 Lakhs Rs. 50.00 Lakhs
	(c) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka

Price Adjustment Formula [40]

R = Value of work as defined in Clause 40.1 of Conditions of Contract.

Adjustment for cement component

(i) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula.

$V_c = 0.85 \times P_c/100 \times R \times (C_i - C_o)/C_o$, Where

V_c = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for cement

C_o = The all India average wholesale price index for cement (Ordinary Portland Cement) for the quarter preceding the date of opening of the tenders as published by the Office of Economic Advisor, Ministry of Commerce and Industry, Government of India , New Delhi;

C_i = The all India average wholesale price index for cement (**Ordinary Portland)** for the quarter under consideration as published by the office of Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi

P_c = Percentage of cement component of the work

Note: *Index for all types of cement shall be considered from Cement –Group provided in the web site www.eaindustry.nic.in.*

Adjustment for steel reinforcement component

(ii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_s/100 \times R \times (S_i - S_o)/S_o$ where,

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for steel (**MS Steel long products**) for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

S_i = The all India average wholesale price index for steel (**MS Steel long products**) for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_s = Percentage of steel reinforcement component of the work

Note: For the application of this clause, index of (**MS Steel long products**) has been chosen to represent steel group.

Adjustment for labour component

(iii) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$V_L = 0.85 \times P_l/100 \times R \times (L_i - L_o)/L_o$ Where,

V_L = increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local labour.

L_o = the average consumer price index for industrial workers for Bangalore centre for the quarter preceding the date of opening of Bids as published by Labour Bureau, Ministry of Labour, Government of India.

L_i = The average consumer price index for industrial workers for Bangalore centre for the quarter under consideration as published by Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

Adjustment of other materials

(iv) Price adjustment for increase or decrease in the cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula:

$V_m = 0.85 \times P_m/100 \times R \times (M_i - M_o)/M_o$ Where,

V_m = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rate for of local materials other than cement, steel, bitumen and POL.

M_o = The all India average wholesale price index (all commodities) for the quarter preceding the date of opening of Bids, as published by the Ministry of Industrial Development, Government of India, New Delhi.

M_i = The all India average wholesale price index (all commodities) for the quarter under consideration as published by Ministry of Industrial Development, Government of India, New Delhi.

P_B = Percentage of local materials other than cement, steel, bitumen and POL of the work.

Adjustment of DI Pipes component

(v) Price adjustment for increase or decrease in the cost of DI Pipe shall be paid in accordance with the following formula:

$V_b = 0.85 \times P_{di}/100 \times R \times (D_i - D_o)/D_o$

V_b = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rate for Pig Iron.

D_o = The all India average Whole Sale price index of Pig Iron on the day 30 days prior to date of opening of Bids.

D_i = The all India average Whole Sale price index of Pig Iron of the quarter under consideration.

P_{di} = Percentage of DI pipe component of the work.

Note: For the application of this clause, index of **Pig Iron** has been chosen.

Adjustment of Plants and Machineries spares Component:

(vi) Price adjustment for increase or decrease in the cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula:

$Vp = 0.85 \times P_p/100 \times R \times (P_i - P_o)/P_{o,}$ Where,

V_p = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for Plant and machinery spares.

P_o = The all India average wholesale price index for Manufacture of Machinery and Equipment for the quarter preceding date of opening of bids, as published by the office of the Economic Advisor, Ministry of commerce and Industry, GoI, New Delhi.

P_i = The all India average wholesale price index for Manufacture of Machinery and Equipment for the quarter under consideration as published by the office of the Economic

Advisor, Ministry of commerce and Industry, GoI, New Delhi.

P_p = Percentage of Plant and machinery component of the work.

Adjustment of MS pipe component

(viii) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_{ms}/100 \times R \times (S_i - S_o)/S_o$

Where,

V_s= Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel.

S_o = The all India average wholesale price index for steel **(Hot Rolled steels and plates (HR) Coils & Sheets, including Narrow Strip)** for the quarter preceding the date of opening of Bids as published by the ministry of Industrial Development, Government of India, New Delhi.

S_i = The all India average wholesale price index for steel **(Hot Rolled steels and plates (HR) Coils & Sheets, including Narrow Strip)** for the quarter under consideration as published by the ministry of Industrial Development, Government of India, New Delhi.

$P_{ms=}$ Percentage of MS pipe component of the work.

Adjustment of POL(Fuel and lubricant) components

(vii) Price adjustment for increase or decrease in the cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula:

$V_f = 0.85 \times P_f/100 \times R \times (F_i - F_o)/F_o$

Where,

V_f = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for Fuel and lubricants.

F_o = The official retail price of high speed diesel (HSD) at the IOC/HPCL/BPL pumps at IOC bunks in Bengaluru on the day 30 days prior to the date of opening of bids.

F_i = The official retail price of high speed diesel (HSD) at the IOC Bengaluru for the 15^{th} day of the middle calendar month of the quarter under consideration

P_f = Percentage of fuel and lubricant component of the work.

Note: For the application of this clause the price of HSD has been chosen to represent fuel and lubricants Group

Adjustment for Bitumen component

(iv) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_B = 0.85 \times P_B/100 \times R \times (B_i - B_o)/B_{o,}$ where

V_B = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for bitumen.

B_o = The official retail price of bitumen at the IOC/HPCL/BPL pumps at IOC bunks in Bengaluru on the day 30 days prior to the date of opening of bids

B_i = The official retail price of bitumen at the IOC/HPCL/BPL or IOC depots at Bengaluru for the 15th day of the middle calendar month of the quarter under consideration

P_B = Percentage of bitumen component of the work

The following percentages will govern the price adjustment for the entire contract:

1.	Labour – P_l	**% will be informed during agreement**
2.	Cement - P_c	**-Do-**
3.	Steel - P_s	**-Do-**
4.	D I Pipe – P_{di}	**-Do-**
5.	Other Materials – P_o	**-Do-**
6.	Plant and Machineries – P_p	**-Do-**
7.	Fuel and Lubricants	**-Do-**
8.	MS pipe- Pms	**-Do-**
9.	Bitumen component-P_B	**-Do-**
Total		**100%**

The liquidated damages for the whole of the works are Rs. ***0.1%*** per day of the contract value and that for the milestones are as under:

The maximum amount of liquidated damages for the whole of the works is ten percent of final contract price. [41]

. [41]

The amounts of the advance payment are: [42]

Contractor
Employer

Nature of Advance	Amount (Rs.)	Conditions to be fulfilled
Installment of Mobilization	5% of the Contract price	On submission of un-conditional Bank Guarantee. (to be drawn before end of 60 days)

Repayment of advance payment for mobilization: [42]
The advance loan shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the contractor has reached not less than 15% of the contract price or 5 months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 7.5 percent of the amounts of all Interim Payment Certificates until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clauses 17 and 26.

The date by which “as-built” drawings (in scale **1:1000**) in 2 sets are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be. [48]

The date by which any Operating and Maintenance Manuals are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be.
[48]

The amount to be withheld for failing to supply “as built” drawings or supply of monthly progress report by the date required is Rs.2,00,000/- [48]

The following events shall also be fundamental breach of the contract : [49.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be ***50*** percent. [50.1]

SECTION 7:

TECHNICAL SPECIFICATIONS

(The Technical Specifications should be in accordance with BOQ specification)

Contractor
Employer

PART - 1 - Introduction

1.1 Salient Features of the City

1.1.1 General Information about the City

Bangalore, the capital city of Karnataka is situated on the watershed of two principal river basins of Arkavathi on the West and South Pennar in the East. Bangalore is one of the fastest developing Metropolitan cities in India and is ranked as sixth largest city in India. Bangalore is an industrial centre of South India and is a centre for research institutions and high-tech electronic houses. The ever-increasing population has resulted in disorderly development and has added more problems to the already strained infrastructure facilities like the water supply and sewerage systems, transportation, electricity, etc. Figure 2.1 shows the location of Bangalore in India. The water supply from all sources for the year 2016-17 is about 1450 Mld.

1.1.2 Location and Topography

The city is located at latitude of 12° 58' North and longitude 77° 36' East. The general elevation of the city varies between 840 m and 940 m above mean sea level. Bangalore is located in the South Deccan Plateau and the topography of the city is characterized by a series of well defined valleys radiating from a ridge of high ground to the North which slopes gradually towards the South.

Physio graphically, the city is strewn with captivating natural features and is more familiar as garden city.

1.1.3 Climate

The city is situated at a fairly high altitude and on account of its elevation Bangalore is bestowed with salubrious and equable climate throughout the year. The mean annual temperature being 24°C with extremes ranging from about 13°C in winter to about 36°C in summer. The average annual rainfall is about 900 mm and it rains between July and September of the year.

1.1.4 Geology

The prevailing rock formation underlying the city is granite gneiss with veins of pegmatite. The elevated areas have outcrops of rock but the low lying areas are covered with a thick layer of red loamy soil. Weathered rock is frequently encountered within 2m from ground level and may persist to depths of 9m to 12m. Where weathering has progressed to sufficient depth, white kaolinite clays are also found. Ground water is normally encountered within 6 to 9m in the low-lying parts of the city it may rise to within 3 m from the ground surface during the rainy season.

1.1.5 Industries and Commercial Activities

Bangalore City is fast developing as an administrative, industrial, trade and commercial and educational centre. Indian Telephone Industries, Hindustan Machine Tools, Indian Space Research Organization, Hindustan Aeronautics Limited, Aeronautical Development Agency and several internationally reputed Electronics and Computer Software Industries are located in Bangalore. The city has been globally acknowledged as the "Silicon Valley in India". In recognition of its importance, many multinational companies have shifted their corporate offices to Bangalore from other cities in India Many other international companies have been setting up their Asian or Indian headquarters in Bangalore. Bangalore essentially has a capital goods industrial base.

1.2 Introduction to project.

The Bengaluru water supply and sewerage Board is vested with the responsibility of providing water supply and safe disposal of waste water generated in the BBMP area. In order to meet the ever-growing water demand of the citizens of Bengaluru, BWSSB has been taking up several new augmentation schemes from time to time. As of now, city is entirely dependent on surface water from river Cauvery which has to be pumped against a head of 500 meters over a distance of 100Km which is highly power intensive and consequently the cost of production and conveyance to the city is very high. However, upon receipt of treated water to the city water is being distributed in a distribution network covering 500 Sq. Km area of Bengaluru. Since the distribution system in core area has very old pipes laid 40 to 50 years ago, the amount of leakage in the system is enormous and calls for immediate steps to plug the same so that the water

saved could be better utilised to meet the growing demand and also to earn revenues commensurate with the services being rendered. Keeping these aspects in view BWSSB has already taken up the work of Improvement of water supply distribution system, reduction in UFW and leakage control in Central parts of the core area of the city under-D1a package, Western parts under-D2a package and Southern parts under-D2b packages through JICA loan under ID-P 168

The reduction in UFW and leakage control project was started in the year 2013 and completed in 2023.

Sl. No.	**Name of the Project**	**No of DMA formed**	**Inital UFW**	**Final UFW Achieved**	**Water saved in ML per day**
1	South Division-D2B	83	49.96%	25.30%	170.31
2	West Division- D2A	83	45.27%	20.33%	
3	Central Division-D1A	43	52.78%	22.55%	

In view of this, it is proposed to take up in further area of Core area of Bangalore where there is an existing old pipeline aged more than 60 to 70 years with lead joint pipelines.

The work comprises the following components:
Design and Construction

- Surveys:
  - Underground assets survey
  - House to house meter connection survey
  - Topographic survey
- Network Modeling:
  - High level (strategic) model of the contract area
  - Low level (detailed) models for each Service Station Area, DMA or group of DMAs
- Up-date BWSSB GIS records
- Plan, design and implement DMAs, including installing boundary valves, circulating valves, step valves, replacement of defective valves, installation of pressure and flow monitoring points, and undertaking Pressure Zero Tests.
- Procure and install electronic district meters suitable for GPRS communication (flow and pressure) to the central SCADA system being designed and installed by others (all to be compatible with the existing district metering facilities in the UFW Pilot Project area).
- Measure the initial level of UFW (leak and non-leak component)
- Procure and install consumer meters for all broken/non-operational consumer meters.

- Replace all corroded or leaking service connections with new Cpvc service pipework and fittings (generally where pipes are replaced, new service connections will also be installed)
- Identify and replace mains, including procurement, installation and commissioning of DI/MS replacement pipes (replacement sizes to be based on network model projections):
  - mains <100mm
  - PVC/PSC mains
  - All lead joint pipelines in project area from 100mm to 600mm dia.
  - Mains required to be up-sized to meet future demands to the design year 2025
- Undertake leakage detection surveys and repairs and re-measure UFW and leakage until the values have been reduced to the target level and to 10% UFW overall.
- Prepare DMA Files and DMA operation and maintenance manuals
- Reporting in hard copy and soft copy as specified (survey reports, DMA design and PZT reports, DMA reports, UFW leakage reduction and control progress reports, cost benefit analysis report, training report, final report, etc.)

Defect liability

This mainly covers one year defect liability period

- Regularly monitor performance of each DMA (flows, pressures, supply hours, leakage and UFW levels, etc.),
- Undertake leakage surveys as necessary, locate and repair leaks and re-measure leakage and UFW until levels reduced to required values.
- Up-date DMA Files as necessary
- Prepare report on final levels of UFW and leakage achieved

1.3.1 Description of the Works

The scope of the contracts includes carrying out detailed underground utility survey, UFW activities and distribution system.

1.3.2 Unaccounted for Water

The work comprises formation of DMAs within the project area for the purpose of measuring bulk water supplied to each DMA and the DMA leakage level, inspection of all revenue meters, fixing of new meters on unmetered water connections or on connections where meters are not working, testing of meters at test benches for accuracy and recording of consumptions on revenue meters. The measured difference between the input into a DMA and water supplied to consumers is the total UFW in the DMA. UFW comprises two components; physical losses (leakage and illegal consumption) and non-physical losses (commercial losses).

1.3.3 Leakage – Physical loss.

To address physical losses, leakage baseline and target levels are to be determined for each DMA and then a programme of active leakage control measures undertaken, comprising leak assessment

and detection surveys, leak repairs and re-measurement of leakage levels, until the DMA leakage is reduced to the target leakage level.
Planning of DMAs is done with the aid of computer network models for each DMA to demonstrate that the proposed DMA establishment works are able to maintain adequate hydraulic capacity of the DMA under 24 hours satisfied demand conditions as well as ensuring no unacceptable detrimental impact on supplies to areas adjacent to the DMA.
The boundaries of the DMAs are required to be watertight to ensure that all DMA inflows and outflows are measured. In order to confirm that the DMA boundaries are watertight Pressure Zero Tests are undertaken to verify that the mains pressure has dropped to zero across all parts of the DMA when the inflow to the DMA is closed.
Step test valve requirements are identified to determine the size and extent of areas within the DMA that can be progressively isolated in order to identify leakage levels across the DMA. New step valves are installed where necessary.

1.3.4 Commercial Losses

(i) Meter Errors

Commercial losses (non-physical losses) from metering errors are reduced by inspecting revenue meters and replacing all defective meters with Class B or better meters, which have a better measurement accuracy than the Class A meters complying with the current BWSSB specification.

All unmetered connections, including stand posts are to be metered for measurement purpose.

(ii) Illegal Connections

As part of the revenue meter surveys, illegal connections are to be identified. These will be brought to the attention of the BWSSB Engineer who would pass on the information to the appropriate O&M division to take action to legalize the connection.

1.3.5 Water Distribution System Rehabilitation

The rehabilitation works include surveys of the water distribution mains in the DMAs and replacement of water mains. Possibility of replacement due to hydraulic inadequacy seems rare. The works also include replacement of leaking service connections with saddle trap and CPVC pipe work. cPVC pipes offer a long-term, leak free installation compared with the current GI service pipes which are prone to early failure due to corrosion of the pipe wall.

PART-2: Methodology to Reduce UFW and Leakage, and for Distribution System Improvement

2.1 Introduction

Reduction of UFW and leakage is greatly assisted by dividing the distribution network into smaller hydraulically isolated areas within which the characteristics of each distinct area can be monitored and assessed, and the impact of any remedial work (for instance leak repairs or pipe replacement) quantified and compared against the initial system characteristics to measure the benefits achieved. Inflow and outflow across the boundaries of such small areas are normally metered, hence the name District Meter Area (DMA).

2.2 General Approach to UFW Control

The initial activity is to collect all data, records and plans of the system to identify potential hydraulic boundaries within which inflows and outflows through a small number of meters can be used to monitor net flows into the DMA. Surveys of the area are undertaken to confirm the location of pipes, valves and fittings and to investigate anomalies so that a detailed record can be prepared of the assets within the DMA. This should include the status of valves (clockwise or anti-clockwise closure, how many turns open, etc.). At the same time a survey is undertaken of consumer connections to confirm BWSSB consumer records, summarise their status (e.g. meter details, working/not working, condition of supply pipe, etc.) and investigate all properties that are not recorded as BWSSB consumers for illegal connections. A pressure survey is also undertaken to identify critical pressure points for future monitoring. Also a survey for finding levels is to be carried out in different pressure points and other relevant points, which will be helpful for sample network modelling and other purposes. A pressure zero test (PZT) is performed to identify any unknown cross-boundary mains for valving off or installation of a further district meter on the pipeline, to ensure that the DMA is hydraulically isolated. This preparatory work is essential to enable DMAs to be designed and a start made on understanding the features of the area and its problems. Work can then start on designing the DMA and installing district meters and repairing existing valves, installing new valves, and installing pressure monitoring points within the DMA.

Following completion of DMA installation, and successful proving of hydraulic isolation from adjacent areas by PZT, the DMA will be established. The initial level of UFW is calculated based on the net inflow to the DMA as measured by the district meters, and the actual quantity of water consumed over the same period as recorded on consumer meters.

2.2.1 Illegal Consumption

Illegal and unauthorized connections identified as part of the consumer surveys referred to above will need to be formalized or disconnected. Further illegal connections may be identified during the leakage survey work and where mains are replaced. The existing illegal connection list needs to be submitted to BWSSB to adopt appropriate procedure and for taking remedial actions either by the contractor or by the Board, including the possibility of imposing penalties on offenders or recovering back-payments. to deal effectively with illegal connections. All illegal connections will be replaced by new connections and class B meters once the instructions are issued by BWSSB.

An assessment of the contribution of illegal connections to UFW can either be assessed by multiplying the number of such connections by the average monthly consumption per connection, or it can be assessed from consumption of those illegal connections subsequently formalized and metered properly.

2.2.2 Metering Errors

Although there is almost universal consumer metering in Bangalore, most meters are metrological class A. However, in low pressure intermittent supply systems such as in Bangalore, most of the flow through consumer meters would be at relatively low flow rates where meter performance is far from optimal. For class A meters the minimum flow rate q_{min} is 0.04 times the nominal flow rate q_n, but for class B meters it is 0.02 times q_n . The starting flow rate is therefore much lower for class B meters than class A, and so class B meters record a greater proportion of consumer consumption.

All meters which are aged 7 years and more, T-Meters and Class-A, single jet meters need to be replaced.The Cosnumer water meters shall be supplied from BWSSB Stores.

2.2.3 Consumer Connections

Corrosion of GI service connection pipes accounted for some 25% of all leaks found in the Contract UFW project, with most leaks found

at the ferrule. Identification of supply pipes in poor condition can be achieved by visual inspection and documentation. Accordingly, new consumer connections, using cPVC pipe, will be installed in the following situations:

- On all connections where the GI pipe is badly corroded or is leaking.
- Where mains are replaced, all connections on them should be replaced at the same time before hydraulic testing of distribution network.
- Clustered connections should be removed and replaced by rider main and new metered connections.
- All identified Public Taps to be provided with new ½" connections and consumer meters.

Where the supply pipe is exposed or is installed beneath roads or high traffic areas, it will be installed in a suitable GI sheath.

2.2.4 Public Taps

The problem of consumption of water through public taps will need to be evaluated and discussed on a case by case basis with BWSSB. The present policy of removing all public taps and replacing them with direct individual or group connections will be continued. Wherever public taps cannot be removed to social obligations, action has to be taken to fix the sample meters and account the consumption for calculation. Detailed arrangements will need to be identified and negotiated with BWSSB and authorized representatives from each slum area, with direct involvement by the contractors, as each situation will require a unique solution to be developed that is cost-effective and acceptable to all.

A public awareness programme is an essential part of the UFW project, encompassing not only general liaison with the public, but in particular to inform communities relying on public taps of proposals to replace them, negotiate appropriate solutions with all stakeholders, prepare them for the changes, and then provide follow-up to ensure a smooth transition to the new arrangements.

2.2.5 Network Modelling

Network models will be developed and network analysis undertaken to ensure the equitable distribution of water and to identify any options for improving network efficiency, for instance by augmenting some pipe lengths or installing new cross-connections to reduce current and likely future bottlenecks with high friction losses. In addition, the models will identify the required replacement pipe size of pipes to be replaced to ensure that they perform satisfactorily, not

only under current demand conditions but also they are adequate to meet future water demands.

2.3 Pipeline Replacement

Cast iron

There is little evidence of external corrosion of metallic pipes in Bangalore, although internal deterioration and tuberculation is common due to the previous practice of installing unlined cast iron pipes. It is already a national technical standard for distribution pipes in major cities to be no smaller than 100mm so it is clear that all existing pipes smaller than this should be replaced by 100mm pipes, or larger as indicated by the network analysis.

It is proposed to replace all the lead joint pipelines in the package boundary with appropriate type of pipes as proposed in the BOQ.

PVC

There are some PVC pipe in the distribution network, the majority being 110mm and 160mm. PVC is also notorious for the ease of making illegal connections as fittings are cheap and readily available in hardware stores, and tapping into them is easy. A further consideration is that in smaller pipe sizes the bedding material and installation may be poor and the probability of pipe damage from sharp rocks and stones, particularly in heavily trafficked streets, is likely to be high. As well as such pipe security problems, PVC pipes are difficult to trace from the ground surface and leakage location in low pressure areas is notoriously difficult. Detailed condition assessment is probably unjustifiable. In view of the problems reported by BWSSB staff with PVC pipes it is proposed that all existing PVC pipes should be replaced as in the report.

2.4 Public Awareness and Community Relations Liaison

A vital element of the UFW project will be the effective communication of information with the general population of Bangalore, as well as with each area concerning detailed work programme and timings. In addition, close liaison with specific communities, such as those living in low income areas and currently relying on stand posts or in slum areas, will also be an essential function. Working with the consultants Community Awareness team, each contractor will set up his own specialist team to ensure the satisfactory and timely promulgation of information to the public,

including any anticipated disruption as well as the progressive achievements of the UFW work, in their contract area. In particular the benefits to the urban poor (for example, improved health and increased days available to work, elimination of manual water collection or reduced collection times, etc.) are to be specifically identified and quantified and then communicated effectively to all stakeholders. The establishment of such teams within each contractor's project organization, together with details of how they would function and achieve these goals, is to be included in contract tenders.

2.5 Detailed Methodology

New consumer applications will be processed by BWSSB, but it is anticipated that the UFW contractor will install them in his DMAs and be reimbursed under the UFW contracts. Although consumers pay for their connection and meter, a service charge is included in the water tariff to cover their maintenance. BWSSB therefore has the right to replace service connections and meters even though ownership is not theirs. The contractor will be reimbursed for new and replacement connections as well as replacement meters under the UFW contract.

During the project period, illegal connections will be identified and either formalized and a new connection installed or disconnected by BWSSB.

The indicative schedule of activities anticipated to be undertaken by the contractors is summarized below:

Mobilisation

Planning and Monitoring

- Plan field activities
- Monitor field activities

Surveys

- Underground asset survey
- Valve condition/location survey
- House to house connection survey, meter survey and meter readings should be carried out, including illegal connections.

Procurement

- District meters, consumer meters, etc.
- Materials (pipes, fittings, valves, pipe cleaning pigs, etc.)
- Tools and plant

- Equipment (loggers, pressure transducers, pipe and valve locators, leak detectors, temporary flow meters, etc.)

Preparatory Work – DMA Formation

- Install district meters or initially measure the flow with temporary measurement.
- Check existing boundary valves and replace as necessary
- Install valves at DMA boundaries.
- Establish pipe repair and mains replacement section
- Establish leak detection section
- Establish data collection and recording section
- Establish human resources section, including Public Awareness and Community Relations Team

Network Modelling

- Prepare network models
- Calibrate models as far as possible based on field test data
- Identify under-sized pipelines and replacement requirements
- Identify additional pipeline options to optimize network performance

UFW Tests – Preparatory Work

- Install flow meter at DMA boundary
- Mobilize plant and equipment for leakage assessment, leak detection

Initial UFW Assessment

- Read district meters and take consumer meters in DMA from Billing sections. Assess initial UFW

Repairs and Replacement

- Obtain necessary permission for road excavation from BBMP/Traffic Police and concerned authorities.
- Co-ordinate with other agencies for site work and also to advise them well in advance of work programme
- Repair leaks and reinstate
- Replace pipelines as approved by the Engineer
- Replace consumer connections as approved by the Engineer
- Carry out repairs as approved by the Engineer
- Obtain Engineers approval before start of work.

Re-Testing for Subsequent Assessment

- Re-test repaired sections of mains, assess reduced leakage level, identify new leaks and repair
- Repeat testing and leak detection/repair cycle until target level reached

Reporting

- Report on equipment for underground asset mapping
- Report on data logging and leak detection equipment

- Up-date plans of water mains and appurtenances
- Report on levels of UFW in each DMA
- Report on leakage, leak locations and other defects found with remedial work proposals
- Progress reports (Monthly, Quarterly, Annually)
- Status reports (as needed)
- UFW Control and DMA Operations Manual
- Final report

PART-3 - TECHNICAL SPECIFICATION.

I. GENERAL

1.1 Scope of Work.

The scope of work under this Contract includes the following:

SCOPE OF WORK

The following activities are included in the Estimate:

* Detailed surveys
- Establishment of DMAs
- Conducting Pressure Zero Tests, Hydraulic discretion
- Replacement of existing 100mm dia, 100mm to 300mm dia C.I. Lead joint pipeline/PVC/PSC pipelines in complete manner by D.I. Pipeline/ M.S. Pipeline.
- Laying of D.I. feeder mains in place of existing C.I. Lead joint pipeline.
- Replacement of consumer service connections(Store supply) associated with pipeline to be replaced
- Replacement of defective and 7 years aged water meters
- Procure and install EMF Bulk flow meters to measure the incoming and outgoing water.
- Monitoring of UFW levels, determination of UFW for all DMA on monthly basis and submission of the UFW report.
- Leak detection and repairs for reduction of UFW to 10 %.
- Determination of Cost-Benefit Analysis and submitting the final report.

After achieving 10% UFW in project areas of proposed DMAs the system shall be maintained for one year under defect liability and replacing of all the batteries of bulk flow meter with the new batteries installed before handing over.

It is proposed to provide house service connections using Cpvc pipes and specials as per specification. The consumer meters are of Class –B Multijet Type. The existing working EMI meters provided to be utilized The non-working meters may be replaced. The proposed period of construction is of 3 years, by the end of second year the UFW should be

reduced to 10% and the same should be maintained for a period of one year.

The evaluation of the work will be considered from the 25th month and any increase in the UFW level over and above 10% (average of 12months of 3rd year) during defect liability period, then the penalty of 5% of the total Contract Valve will be deducted.

Project procedure.

- The precise project boundary should be identified based on the flow.
- The Bulk flow meter wherever necessary shall be fixed in the Inflow and Outflow locations of project area.
- The existing UFW level will be accessed for the initial UFW for project area.
- The replacement of all the C.I. Lead joint network in section wise considering the flow network.
- Replacement of HSC @ 100% will be made and pipelines so laid will be hydraulically tested.
- After commissioning the new network, the flow will be measured and UFW will be calculated.
- The replacement of Consumer Water meters will be taken up for 7 years and above aged, single jet meters, T- Meters etc.,
- All activity will be started to bring down the UFW level to 10% including parallel measurement of consumer meters and rectification.
- The visible leaks of existing network during project period within the project boundary will be made by the successful bidder until replacement of all networks and commissioning.

The project period will be of 'Three years' for execution and one year maintenance during 'defect liability period', all leak activity during 'defect liability period' will be carried out by contractor and hand over the system to BWSSB.

Details of works to be executed under pipeline work.

1.1.1 Providing and Laying of 100mm dia and above **DI K-9 Class** including construction of valve cistern etc.,

1.1.2 Earthwork in all kinds of soil, hard rock. The pipeline is to be laid in the developed city roads with traffic

1.1.3 Fixing and connecting all pipelines fixtures like valves, bends, tees and other specials as specified in the construction drawings, construction all appurtenant structures such as pipe supports, valve chambers, thrust blocks, etc.,

1.1.4 Backfilling the trenches, restoring and making good all surfaces which are damaged during excavation.

1.1.5 Dismantling and reconstruction of structures such as culverts, storm water drains, roads etc., and utility lines such as water supply pipe lines, sewer lines coming in the way of the pipeline alignment.

1.1.6 Testing and commissioning of the pipe line after laying in segments and complete system.

1.1.7 Maintenance of all the pipelines for 12 months after commissioning. During this period, the contractor has to set right the defect of any kind in the manufacture, laying and jointing of all the pipelines and in the other works in this scope of tender.

1.1.8 All work shall be done as per the specifications. The works shall include providing all materials, equipments, labour, tools, plants, transport etc., and all other services necessary for the complete construction including necessary sub-soil investigations.

1.1.9 The alignment of the pipeline and other typical details of pipe bedding, valve chambers, thrust blocks, pipe supports, and the general arrangement are furnished in Drawings. Further details shall be furnished in the construction drawings during the construction stage if found necessary.

1.2 Construction Methodology

1.2.1 Tenderer shall submit the detailed construction methodology along the clear programme of works while submitting the tender. The methodology shall include the safety measures to be adopted in the execution of work. Tenderer shall express in detail the methodology for addressing the Social & Environment factors during the execution of work.

1.3 Site Order Book

1.3.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the Contractor. After compliance with the instruction, the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer shall retain the original copy of the Site Order Book, while the Contractor shall retain the duplicate one.

1.4 Quarry Materials

1.4.1 The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, muram, etc., and to make his own arrangements for collection and transportation of the materials irrespective of the leads and lifts required. The quarry thus identified by the Contractor should have proper license from the Government of Karnataka. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications and shall be subject to the approval of the Engineer. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account.

1.4.2 **Royalties:** The Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the Karnataka Minor Minerals Concession Rules - 1969" as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached.

1.5 Inspection and testing

1.5.1 Inspection of Material to be procured

Inspection and certification of all materials used on the works such as DI Pipes and Specials , Valves, Cement, Size Stones, Sand aggregate, Lead, Rubber gaskets etc., for conformity with specifications of BIS. If insisted, inspection of materials at the manufacture place shall be arranged by the contractor at his cost including the travelling and accommodation of the inspecting officer.

1.5.2 **Inspection and certification of the various components of works.**

Construction of DI pipeline with all fixtures, construction of Valve Chamber including back filling of trench in layers with compaction as specified to ensure that all components of works are carried out as per specification and to required standards.

Inspection & Certification of Hydraulic Test on Completed pipe line in reaches and as a whole network as specified shall be carried out. The hydraulic testing of the pipelines is to be certified by the third party and the in charge BWSSB Engineer.

1.6 Technical Specifications

1.6.1 Engineer shall have the right to modify/alter the Particular Specifications and/or Standard Specifications at any time which promise to confer equal or better quality than the standard specified in the tender document. Such modification or alteration shall be acceptable to the Contractor subject to no additional financial burden to either the Contractor or the Employer.

1.7 Storage of Materials and Plant

1.7.1 The Contractor shall provide appropriate storage facilities for materials like cement, steel, aggregates, consumable supplies, equipment, mechanical and electrical items, etc., and shall take all safety and security measures against theft and deterioration in quality, at his own cost.

1.8 Procurement of Materials:

1.8.1 CEMENT:

The Contractor shall use only 43 grade cement conforming to IS 8112 / 89 with latest amendments with ISI mark. The Contractor should furnish the manufacturer test certificate for the above brand of cement for having manufactured the cement as per relevant BIS and guarantee certificate before using the cement.

1.8.2 STEEL: The Contractor shall procure the steel from VISL/SAIL/VSP/TISCO and manufacturer's test certificate is to be produced. If the contractor wish to procure from any other manufacturer's, then the necessary prior approval of the new Vendor is to be obtained from BWSSB.

1.8.3. DI PIPES and D.I. Specials.

Sl. No.	**Description**	**Make**
	DI Pipes	Electrosteel, Lanco Kalahasti, Jindal SAW, Tata, Sathavahana
	DI Specials	Electrosteel, Kiswok, Kezrival Castings Ltd., Zindal

1.8.4. For Bulk Flow Meters: Please refer Section-7, PART – 4. Pipeline ancillary works for detailed specifications.

1.8.5. For CPVC Pipes: Section-7, PART – 4. Pipeline ancillary works for detailed specifications.

1.8.6. For Saddles and HSC materials. – Section-7, PART – 4. Pipeline ancillary works for detailed specifications.

The above branded makes are preferred. Board can specify any make among the above brands and rates quoted shall have provision for supply any make specified among the list. If contractor wish to procure material from any other reputed manufactures, prior approval of the Board is required and can be obtained by requesting the Board along with the credential of such manufacture and standards of the material intended for procurement.

1.9 Equivalency of Standards and be procured, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative

standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

1.10 Sign Board

1.10.1 The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description of the Project, (iv) the amount of the Contract Price; and (v) the starting and completion dates.

1.11 Samples and Tests

1.11.1 The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contract. Without limiting the generality of the foregoing, the Contractor shall either

(i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and/or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, provided the correctness of the equipments are ensured or

(ii) Arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer up to 5% of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

1.11.2 The Contractor shall, within 14 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a detailed description of the arrangements for conducting the quality control programme during execution of the Works, including details of his

testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control programme is not adequate to ensure the quality of the Works, the Contractor shall produce a revised programme which will be adequate to ensure satisfactory quality control.

1.12 Protection of Utilities

1.12.1 The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer. In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

II EARTH WORK:

2.1 GENERAL:

2.1.1 The earth work excavation for laying of pipe shall be carried out. The Contractor should use concrete / asphalt cutting machines strictly for asphalt cutting and concrete surface cutting and the width of cutting should not exceed the required approved width. The adjoining surface should not be damaged while excavation. i.e. use of JCB excavator is limited and without haphazard width excavation

The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required in the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut to the specified widths and depths. The Contractor is advised to satisfy himself with regard to the likely conditions that may be met with during the execution of the Works, with regard to the underground obstructions or conditions, necessary dewatering

requirements etc. Before commencing the earth work, the Contractor shall carry out detailed survey of the proposed alignment, prepare construction drawings showing the longitudinal section of the ground profile, locations of valves and other appurtenances and submit to the Employer for approval.

2.2 CLASSIFICATION OF EXCAVATION

All materials involved in excavation shall be classified in three categories as follows:

2.2.1 **Ordinary soil:** This includes excavation in all types of soil including soil containing gravels, murrums, loose boulders, viz., ordinary gravely soil, hard gravely soil, wet soil, stiff slushy soil, chettu soil and calcareous strata, but exclusive of disintegrated rock, soft rock/shale;

2.2.2 **Soil Containing Disintegrated Rock, Soft Rock and Soft Shale:** This category includes excavation in soil containing disintegrated rock, soft rock or soft shale which can be cut by shovel and no hand or mechanical chiseling is required.

2.2.3 **Medium Hard Rock:** This category includes excavation in lime stone, sand stone, hard shale and schist fissured rock, without resorting to blasting.

2.2.4 **Hard Rock:** This category includes excavation in hard rock requiring hand or mechanical chiseling or blasting. In case of difference in opinion between the classification of rock requiring blasting and that requiring chiseling, wedging, the site of work shall be inspected by the engineer and the decision of the Engineer shall be final and binding on the Contractor.

2.3 LIMITATION OF EXCAVATION

2.3.1 The trench for laying DI pipes shall have minimum width as per standards stipulated or as directed by the Engineer-in-charge. A minimum earth cover of 1.0 m shall be maintained above the pipe top, unless otherwise specified or shown in the alignment drawings.

2.3.2 The Contractor shall be responsible to ensure that the widths and depths of the trenches do not exceed the limits shown in the construction drawings. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Contractor on account of this.

2.4 TRIAL PITS

2.4.1 Trial pits may be dug by the Contractor, without being directed to do so, along the alignment as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of under ground obstructions or soil conditions, type of existing materials, dia. Of pipeline etc., complete.

2.5 SLIPS AND SLIDES

2.5.1 The Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost.

2.6 STOCKING OF EXCAVATED MATERIALS

2.6.1 The excavated material shall be stacked on the sides of the trench wherever possible. Wherever it is not possible to stock on the sides of the trench, contractor has to find the place nearby for stocking the excavated material and cart the materials to & fro. Rate for this shall be included in the earthwork itself and no extra rate will be paid for this.

2.6.2 Surplus earth is to be disposed off to a place identified by the contractor approved by the engineer. There is a item for this work and will be paid accordingly.

2.7 Safety measures

The Contractor shall provide adequate safety measures during excavation. They shall include:

1. Barricading all sides of the open trenches.
2. Red danger lights which can be easily visible from dusk to dawn placed at an interval of 20 m.
3. Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.
4. Adequate safe wooden plank / board or steel plate over the trenches to facilitate crossing by the public residing on either side of the trench.
5. Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorized intrusions.

2.8 Progress of Excavation of pipe trenches

The Contractor shall adjust excavation of trenches in such lengths that the pipes can be laid in such exposed portion of the trench within 2 days.

2.9 Shoring and Bracing

The Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at the Contractor's request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

All sheathing, shoring and bracing which are left in place under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

2.10 EXCAVATION

2.10.1 Excavation in Rock

Excavation in rock shall be carried out to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus minimum working space on either side as given in drawing. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 50 m in advance of the pipe length proposed to be laid.

2.10.2 Excavation for Valve Chambers and Other Appurtenant Structures

The Contractor shall excavate as required for all structures with foundations to firm, undisturbed earth up to the level of the under side of the structure. If the excavation is in rock, the Contractor shall excavate all rock at least to the minimum limits shown on the standard details for trenches and to the grade of the bottom of inlets, junction chambers or other structures as required. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built. The Contractor shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

2.11 Contractor's Responsibility

The Contractor shall be responsible for the adequate pumping, drainage and bailing out water from the excavated trench. In case of failure to make such provisions or any other provisions which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item.

2.12 Works Included in Excavation

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

1. Provision of side space or additional space in the trench/pit for working and/or accommodating sheathing, shoring, bracing, etc.
2. Supply, installation and removal after the work, all sheathing, shoring and bracing required to protect the excavation where required or where such work is recommended by the Engineer.
3. Protection of excavations.
4. Providing adequate safety measures.
5. Additional work in connection with overhead wires and poles.
6. Excavation for Socket hallows.
7. Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work.

2.13 Measurement and Payment for Excavation

2.13.1 For Excavation

The measurement for excavation shall be considering the allowable widths, depths with allowed side slopes (if any) for different classes of soils as per approved classification. The measurement for excavation shall be based on "neat line" dimensions as specified in the drawing or Specifications, for different types of soils and depth of excavation. The total volume of excavation shall be computed as a square bottomed trench of width equal to the outer diameter of the pipe, with minimum working space as given in the drawing, added to it, length up to the length of the trench being measured. The depth of trench being average depth taken at 30 m intervals, between the level of bottom of trench and the original surface of the ground. The length of the trench shall be measured as per the actual length of pipes and fittings / specials laid at work site. However depth shall be measured at closure intervals at vulnerable places. The volume of excavation for structures like valve chambers, thrust blocks and anchor blocks etc., shall be computed and measured for payment as per the bottom area of the particular structure on outer periphery multiplied by the average depth between the level of the finished bottom of the structure and the original surface of the ground. The quantity shall be measured in cubic meters correct to two decimal places. The method of measurement for excavation in different classes of soils shall be as follows:

2.13.2 In Ordinary Soil and Soil Mixed with Disintegrated Rock and Soft Rock / Shale

In this category of soils, the excavation quantity shall be computed as specified above.

2.13.3 In Hard rock

In case of hard rock requiring chipping or chiseling, measurements shall be taken prior to and after chiseling and the volume of rock excavation shall be measured based on this difference. The

excavation in rock shall be paid on stack measurements with a deduction of 40% in volume for voids.

2.13.4 For Excavation in Combination of Ordinary Soil, Disintegrated Rock, Soft Rock/Shale and Hard Rock/Schist

Wherever the excavation is undertaken in combination of ordinary soil, disintegrated rock, soft rock /shale and hard rock, the hard rock part shall be measured and paid, the soil part shall be measured and paid for the total measurable excavated quantity deducting the quantity measured for the hard rock. The total computed volume of excavation shall be equal to the sum of the computed volumes for each category of excavation undertaken.

2.14 Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning all utility lines such as water, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting or realignment of water, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may be done by the Employer. The cost of such relocation will be borne by the Employer.

In case the alignment of the pipeline crosses high tension electrical transmission lines belonging to the Karnataka Power Transmission Corporation Ltd. (KPTCL) or other authorities, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

III BEDDING.

3.1. Bedding for the pipe

Bedding shall be provided all along the stretch of the pipe line, which differs based on the area through which the pipe line passes. However, the type of bedding to be provided shall be as decided by the Engineer.

3.2 Earth Bedding

The pipes shall be placed on the natural, undisturbed earth bedding, which has been carefully shaped to fit the lower part of the pipe for a width of at least 50 % of its external diameter. The trench shall be excavated to an extra breadth and depth, wherever weld joints are coming. Filling and removing earth or similar materials beneath the pipe to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum.

3.3 Gravel Bedding

Wherever rock is met with, it shall be removed up to 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel. The granular material shall be filled in the trench up to the level of ¼ the outer diameter of the pipe line, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

3.4 Measurement for bedding:

The Contractor shall include the cost of earth bedding required for the pipeline in the tendered rate for pipe laying, for providing gravel bedding. The surplus quantity of excavated earth shall be disposed off. The quantity shall be measured in cubic meter correct to two decimal points.

IV BACK FILLING

4.1 General

The Contractor shall use selected surplus spoils from excavated materials for backfilling. All fill material shall be subject to Engineer’s approval. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS: 3114-1994 and Clause 4.11 of IS 12288-1987.

4.2 Method of Backfilling

Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship.

4.2.1 Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimise future settlement as much as is reasonably possible. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

4.2.2 Backfilling in trenches shall be done as pipe laying progresses, with the permission of the Engineer, after the pipe or conduit is properly bedded, jointed and inspected and all measurements for the location of Y-Junctions, tees, etc., are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. However, the joints shall be left open for inspection during testing, which shall be backfilled after successful completion of testing, after obtaining permission from the Engineer. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure. For the purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:

i. Zone A : From bottom of trench to the centre line of pipe,
ii. Zone B : From the level of centre line of pipe to a level of 300 mm above the top of pipe,
iii. Zone C : From a level of 300 mm above the top of pipe to the top of trench.

4.2.3 Backfilling in the trenches and around structures shall be carried out in horizontal layers of uniform thickness of not more than 150 mm when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling with water. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

4.2.4 After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. Even in this case the backfill material shall be placed in uniform horizontal layers of not more than 150 mm thickness. Small pebbles of size less than 50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. The backfill material shall be tamped with mechanical tamping equipment, after moistening the backfill by sprinkling with water to obtain maximum compaction (min 95% proctor density).

4.2.5 Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment.

4.2.6 If the trench is subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure.

4.2.7 Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

4.2.8 If from the excavated soil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits is required to be placed for backfill, on approval of the Engineer backfilling of trenches where the excavation is in the rock shall be with the surplus soft soil, with all lead and lift.

4.3 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be removed and spread at places shown by the Engineer, with all lead and lift from the site of work, for which payment shall be made as per the quoted rates. No surplus or excess material shall be disposed in a stream / channel or in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer.

V DUCTILE IRON PIPELINE

5.1 Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile Iron pipeline and fittings including associated civil works required for the same.

5.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS:8329 Centrifugally Cast (Spun) ductile Iron Pressure pipes for water, gas and sewage.

IS:638 Sheet rubber jointing and rubber insertion jointing.

IS:1387 General requirements for supply of metallurgical materials**.**

IS:1500 Methods for Brinell Hardness test for metallic materials.

IS:9523 Ductile Iron fittings for pressure pipes for water, gas and sewage.

IS:12820 Dimentional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.

ISO:4179 Ductile iron pipes for pressure and nonpressure – Centrifugal cement mortar lining – General requirements.

ISO:2531 Ductile iron pipes, fittings and accessories for pressure pipe lines.

IS:5382 Specification for Rubber Sealing rings for Gas mains, water mains and sewers.

AWWA C600 Installation of ductile iron water mains and their appuratenances.

IS:11906 Recommendations for cement-mortor lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

IS:3764 Excavation work – code of safety.

IS:12288 Code of practice for use & laying of Ductile iron pipes.

IS:460 Test sieves – Part I

IS:8112 Specification for 43 Grade Ordinary Portland Cement.

BS 3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.

BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.

ISO 81790 For zinc coating.

5.3. Manufacture of pipe

DI pipes and fittings (Class K7 & K9) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer.

If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal.

The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one.

In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring.

In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the centre line. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

a). Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 - 2000 and IS: 9523 - 2000.

b). Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Pipe of standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS: 8329/IS: 9523. Each pipe shall be of uniform thickness throughout its length.
The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

5.4 Testing

(a) **Mechanical tests**
Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS: 8329/IS: 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The tests results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS: 8329/IS: 9523.

(b) Brinell Hardness Test
For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

(c) **Retests**
If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the tests results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

(d) Hydrostatic Test
For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/IS9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with a 700 g hammer for conformation of satisfactory sound. They shall with stand the pressure test without showing any leakage, sweating or other defect of any

kind. The hydrostatic test shall be conducted before surface coating and lining.
During manufacture, tests on pipes shall be carried out in accordance with **clause 1.2.8 of this Technical specification** by the Third party inspecting agency.

5.5 Jointing of pipes

(a) General

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

(b) Spigot and Socket joints

These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.
The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

(c) Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

(d) Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.
Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

5.6 Specials

Standard DI fitting shall be in accordance with IS:9523. Wherever standard DI specials are not available, they shall be manufactured and tested as per requirements with the approval of Engineer.

5.7 Coatings

i). General

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

ii). Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.
Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

iii). Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer. The curing shall commence immediately after completion of the mortar lining, shall not be later than 8 hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of minimum 14 days.
Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.
Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

5.8. Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a). Internal diameter of pipe.
b). Class of pipe.
c). Date of manufacture and
d). Name of manufacture or his registered trade-mark or both.

5.9. Carting & Handling.
Carting and handling of D.I. pipes and fittings shall be in accordance with the clause 3.4. of GSW pipes specifications.

5.10. Trenching.
Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of part-2 Earth work excavations clause 2.0 to 2.17.wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of

the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.
Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.

The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the pipe when laid in its correct position, shall, unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Side Clearance (mm)
350 to 600	200	300
> 600 to 800	200	350

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increase shall be approved by the Engineer.

All trenches deeper than 1.2 m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench if required. The Contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.

No excavations with battered sides shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.

The Contractor shall erect temporary fencing around all open excavations and post warning signs in English and the local language. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The Contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m or as directed by Engineer. The opening of two lengths within 500 m of each other shall require the approval of the Engineer.

The excavation shall be kept free of water to allow: placing of bedding, laying of pipes. inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.

The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required.

To protect persons from injury and to avoid damage to property, adequate barricades, construction signs. red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.

The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants. sluice valves, manholes cover etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Engineer may direct.

Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting e rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer ma direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipe line of water, gas, sewage etc.

5.11 Deleted

5.12 Laying of pipes and fittings.

Pipes and fittings shall be laid in accordance with IS 12288 and manufacturers instructions.

The pipeline shall be constructed in lengths with a separate full-time gang working on each length. The work on lengths may proceed concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the Contract. Any subsequent changes to the programme shall be submitted to and approved by the Engineer before work to a different programme is started. Excavation for the pipeline in anyone length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipes shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of ± 10mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineer.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipeline under construction to anyone gradient.

The Contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the requirements of this Specification. The Contractor shall obtain from manufacturers all special information regarding the handling of the pipes, joints and other fittings and he will be deemed to have made himself thoroughly conversant with all phases of pipe laying before commencing' the' works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progresses. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the Contractor shall plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. The plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas , sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering or aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which

case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2° for 600 mm and 800 mm, 3° for 300 mm, 350 and 450 mm diameter pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as per manufacturers' recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe: cutting machine shall be used.

The valve chamber frame and cover (Cast Iron and Fibre reinforced concrete) shall be as specified in Part 24. clause 24.3.11.

5.13 Thrust / Anchor Blocks.

Anchor blocks shall be provided at horizontal bends. vertical bends or/and at intervals on pipelines with gradients in excess of 1 in 6 as noted on the Drawings, and at other locations ordered by the Engineer. The anchorages shall be made from concrete and constructed to the dimensions shown on the Drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the Contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown.

5.14 Backfilling

Trenches shall be backfilled with approved selected excavated material only after the successful testing of the pipeline as directed by Engineer. Backfilling shall be in accordance with requirements specified hereafter and as shown on Drawings.

On completion of the pipe laying operations in any section, for a length of about 100 m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the

length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he IS satisfied with the progress of laying and testing of pipes and refilling of trenches. Filling to a level of 300 mm above the crown of the pipe shall be done in accordance with the requirements of the clause on bedding. Care shall be taken during backfilling, not to injure or disturb the pipes,' joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline shall not be permitted unless the trench has been filled with the instructed bedding and surround material up to height of at least 300 mm over the top of the pipe except as may be necessary for tamping etc., during backfilling work.

The remaining portion of the trench shall be filled in with selected excavated material free from and topsoil, vegetation or boulders and clods of earth larger than 75 mm in size. Filling shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming etc., so as to be compacted to 95% of the maximum dry density as per Part 7 of 18:2720. The water contents of the soil shall be kept as near the optimum moisture content as possible. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The surface of the refilled excavations shall be left slightly higher than the adjacent ground and be maintained by the Contractor to a smooth even slope.

The Engineer shall, at all times. have powers to decide which portion of the excavated materials shall be used for filling and in which portion of the site and in what manner it shall be so used.

If suitable material for refilling is not available from already excavated material the Contractor shall import material of approved quality as directed by the Engineer. Unless expressly specified in the Bill of Quantities. the Contractor shall include the above under backfilling rates.

Regular measurement of the field dry density shall be taken by the Contractor at various levels in the backfilling as required by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval from the Engineer has been obtained.

Should any subsidence take place either in the filling of the trenches or near about it during the works the Contractor shall make good the same at his own cost.

Surplus excavated material shall be used to fill in any low spots above the pipeline which are identified on the Drawings or are instructed by the Engineer. Such material shall be evenly placed and compacted in layers not exceeding 200 mm thick after compaction. The method of compaction employed shall achieve not less than 90% maximum dry density as determined from IS 2720: Part 7. Unless approved of by the Engineer, the width of areas to be filled shall not exceed 20m.

5.15 Pipelines under existing roads.

The Contractor shall programme the Works to reduce disruption to road traffic to a minimum, and before any work commences in existing roads shall:

(a) Obtain the full permission and approval of all authorities concerned serving notices of intent to start work as may be necessary and observing all the local Laws and Regulations

(i) Submit details of his proposals, and obtain approval from the Engineer and local highway authority

(ii) Constructing of temporary diversion roads

The pipelines crossing roads shall be encased in M15 concrete as shown on the drawings.

Pipelines which are laid along a road shall be laid in trench. The bed and surround shall be previously specified but above this the trench shall be backfilled with crushed rock up to the underside of the road sub-base. Not more than 20 % of the crushed rock shall pass through a IS test sieve with 4.75 mm apertures and all material shall pass through a IS test sieve having an aperture of 40 mm. The backfill shall be compacted in layers having a maximum thickness of 200 mm and the method of compaction used shall achieve not less than 95 % maximum dry density as determined from IS 2720: Part 7.

5.16 Cleaning of Pipes and fittings.

Pipelines shall be cleaned of all dirt, debris. dust or other deposits before hydraulic test to the satisfaction of Engineer. Cleaning with metal cleaning solution, acid, wire brushes, scrappers or sand paper shall not be permitted.

The section of the pipeline once cleaned shall not be entered into for any purpose later. Sufficient precaution shall be taken to prevent the ingress of any dirt, debris, or dust inside the section. Failing this the section shall be cleaned again at the discretion of the Engineer. When deemed necessary by the Engineer suitable closures shall be provided at the open end or the ends of the cleaned sections

In the case of above ground pipeline, the length of the section to be taken up for cleaning shall be decided in consultation with the Engineer from the point of view of ventilation etc.

In case of buried pipeline a section shall be taken up for cleaning after the work of back filling around and over the pipeline is completed and the spiders have been removed from inside with approval of Engineer.

Pipelines shall be cleaned through a foam swab. Swabbing shall be carried out successively between adjacent swabbing points. The foam swab shall comply with the following:

Pipeline over DN 300 - Swab dia = Pipe dia + 75mm

Quality of swab shall be hard - when restrictions in the main do not reduce the diameter of the pipeline to less than two thirds of the swab diameter

Quality of swab shall be soft - when restrictions in the main are in excess of the above but do not reduce the diameter of the pipeline to less than one half of the swab diameter.

The Contractor shall make necessary arrangements for equipment, fittings and water necessary for cleaning the pipeline. The Contractor shall submit proposals for swabbing, water storage and disposal arrangements to the Engineer for approval.

No separate payment will be made for the work of cleaning and providing closures. The rates quoted for the laying of pipes shall include the cost of cleaning also.

5.17 Hydraulic Testing

Pipelines and fittings shall be subjected to hydraulic pressure tests in the presence of the Engineer which shall comply with IS 12288 unless otherwise specified.

Testing shall be carried out in two stages;

(i) Test of sections as construction proceeds

(ii) A test of the whole of the pipeline on completion

The Contractor shall equip himself with all plant, equipment, fittings and water necessary for the hydraulic tests. The Contractor shall submit to the Engineer, well in advance of the time of tests, details of his proposals, including the supply of water either by tankers or boreholes. No connections from the existing pipelines will be allowed, nor will any connections to the pipeline and pipe work which would involve cutting, tapping or altering the Permanent Works be allowed.

Test gauges shall be of approved manufacture having dials at least 200 mm diameter. graduated such that the test pressure is at least 75 % of the full-scale reading shall be used, If necessary different gauges shall be supplied for different pipeline sections. Two gauges shall be provided for the sole use of the Engineer and shall remain in Engineer's possession for the duration of the Contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as required by the Engineer.

The Contractor's arrangements for testing shall include a suitable means of quick installation and removal of the Engineer's gauges during testing.

5.18 Hydraulic Testing Pipelines

The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid, Jointed and backfilled to a depth sufficient to prevent floatation, but leaving the joints exposed which have not been tested, the sections to be tested shall be to the approval of the Engineer and shall not be longer than 2000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the Test on Completion,

In addition to the above requirements the Contractor shall perform a hydraulic test on the first 200 m length of pipeline to be laid under the contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes. Should the pipeline fail the test or the Contractor fails to undertake the test, all laying work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of

several hours until the pressure can be maintained without additional pumping.

The pressure shall then be slowly increased at a maximum rate of I bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall pass the test if the leakage is not more than 1.079 litres per mm diameter per kilometre per 24 hours for each 100m head of pressure applied and the full test pressure has been sustained for at least eight hours.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The Test on Completion shall be carried out after all the pipeline sections have been satisfactorily tested and the Joints between each section completed to provide a continuous test length between contract interfaces.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

5.18.1 Test pressures

Test pressures are to be measured in bars at the centre of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawings pipeline test pressure shall be in accordance with the following:

DI /MS pipe and fittings without HSC 10 bar

DI /MS Pipes and fitting with HSC 05 bar

For testing of sections of pipeline containing air valve chambers the Contractor shall verify from manufacturer that the air valves are capable of operating under and sustaining the test pressure.

5.19 Chamber Markings

Details like valve type. size, cistern number shall be painted on all valve chambers as directed by Engineer. Where valve chambers are flush with the ground, suitable marker posts shall be provided adjacent to the chambers at a suitable location with all details approved by Engineer.

In case of the pipeline laid above ground details such as chainage, invert levels of pipe, saddle number, culvert number, anchor/thrust block number etc., shall be suitably painted either on the pipeline or the supporting structure in distinct colour.

5.20 Measurement and Payment

The measurement for pipes for items specified in Bill of Quantities shall be on running metres of net length along the centre line of the pipe excluding the length of specials and appurtenances. Payment for pipes shall be made in running metres after production of test certificates specified and directed by Engineer.

Payment for laying the pipes and specials shall be made after successful testing at site.

5.21 Location and Protection of Existing Public and Private Utilities.

Once permission to work has been obtained from the road authorities, and prior to excavation, the Contractor shall contact all utility companies and householders in roads where work is to take place and inform them of the nature of the work and its likely duration. Information should be obtained from utilities companies about the location of their utilities, preferably in the form of record drawings, and the Contractor should carry out utilities tracing using electronic equipment to verify the positions of utilities. Trial excavations should also be carried by hand to further confirm locations of utilities. The Engineer will only permit trench excavation to proceed when he is satisfied that adequate efforts have been made to establish the alignments and depths of existing utilities.

All underground utilities such as water pipes, gas pipes, drains, sewers, electricity and telephone cables exposed in excavations, shall be properly supported and protected by the Contractor to the satisfaction of the Engineer so as to avoid damage to the utility or to the Works as a result of collapse of the utility. Similarly, poles carrying overhead electricity and telephone wires should be braced and supported where there is any likelihood of collapse as a result of excavation.

5.22 Valves-Deleted- Given in subsequent sections.

VI. ANCILLARY STRUCTURES

6.1 The Contractor shall build Valve Chambers & Thrust Blocks/Anchor blocks and such other miscellaneous structures that may be required at the locations shown by the Engineer and as shown in the drawings or as may be otherwise specified or directed. unless otherwise specified in this Chapter or advised by the Engineer based on the site conditions.

The various structures shall be built as the pipe laying progresses and the Engineer at his discretion, may stop work entirely on the laying of pipe or construction of other structures, until the construction of the structures already approved by the Engineer are completed by the Contractor.

6.2 Thrust Blocks

Thrust blocks shall be provided for both horizontal and vertical bends as suggested, for effective transfer the hydrostatic thrust developed during the operation of the rising main. They shall be constructed at the locations shown in the alignment drawings, and are of the respective dimensions shown therein. The surrounding virgin land of the thrust blocks shall not be disturbed, to effectively transfer the thrust developed in the main.

6.3 Valve Chambers

RCC valve chambers shall be provided for all valves. These valve chambers are of different sizes suitable for air valves, scour valves & Control valves with RCC pre-cast slabs covering.

6.4 Structures for Crossing Canal/ Nallahs and Other Miscellaneous Structures

Structures for crossing the pipeline over canals/Nallahs and other miscellaneous structures not listed in these specifications but may be required to be built shall be as per construction drawings and as described in Bill of quantities. The materials of construction of workmanship for those structures shall conform to the relevant Standard Specifications. The measurement of quantities involved in these structures for payment shall be done as per dimensions of the respective drawings.

6.5 Grade of concrete

6.5.1 Ordinary Concrete

In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades designated as M 7.5, M 10, M 15 and M 20. It can also be specified by volumetric mix as given in Table-4 below. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic meters in volume. Shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is

damp, allowance for 'bulkage' shall be made as per IS: 2386 (Part III).

Ingredients required for ordinary concrete containing one bag of cement for different proportions of mix shall be as given in Table-4 below.

Table-4

Ingredients Required for Ordinary Concrete

Grade of Concrete*	Nominal Mix by volume Cement: Fine Aggregate: Coarse Aggregate**	Total quantity of dry in kg (max) by mass per 50 kg of cement (to be taken as the individual masses of fine and coarse aggregates)	Quantity of water in liters (max) per 50 kg of cement***
M 7.5	1:4:8	625	45
M 10	1:3:6	480	34
M 15	1:2:4	350	32
M 20	1:1.5:3	250	30

* In the designation of a concrete mix, letter 'M' refers to the mix and the number refers to the specified 28 days' works compressive strength of that mix on 150 mm cubes, expressed in N/ sq. mm.

** The proportions of the aggregate shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

*** The amount of water should be kept minimum required for proper workability. The quantity given in the column is not to be exceeded.

6.6 Strength Requirement of Concrete

Where Ordinary Portland Cement conforming to IS.269 or Portland Blast Furnace Cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table-5. Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in Table-5 shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 per cent higher than that required on work tests for concrete up to and including M 25, and 25 per cent higher for higher grades. Preliminary tests need not be made in case of 'ordinary concrete'.

Table-5 : Strength Requirements

Grade of Concrete	**Compressive test Strength on 150 mm cubes after testing in accordance with IS: 516 (N/sq.mm)**	
	Minimum at 7 days	**Minimum at 28 days**

M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25

In all cases, the 28 days compressive strength specified in Table-5 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table-5, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

6.7 Use of Plums in Ordinary Concrete

Stone Plums shall not be used unless specified in the drawings. When stone plums are used, the size may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substances in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete-laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave portion upwards. The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums. The total volume of plums shall not exceed 15% of the volume of the finished concrete.

VI MILD STEEL PIPELINE

6.1 Scope

This specification covers the general requirements for fabrication, laying, testing and commissioning of longitudinal & circumferential welded mild steel SAW pipes above /below ground, including associated civil works required for the same.

6.2 Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS 2062	Steel for general structural purposes
IS 808	Dimensions for hot rolled steel beam, column channel and angle sections
IS 814	Covered Electrodes for manual metal arc welding for carbon and carbon manganese steel
BS 5155	Specifications for butterfly valves
AWSS-5.1	Specification for mild steel covered arc welding electrodes
IS 3613	Acceptance tests for wire flux combination for submerged arc welding
AWS: A-5.17	Specification for Bare Mild Steel Electrodes and Fluxes for submerged arc welding
IS1367	Technical supply conditions for threaded steel fasteners.
IS2016	Plain washers
IS2074	Ready mixed paint, air dying, red oxide zinc chrome. Priming
IS1786	High yield strength deformed steel bars and wires for concrete reinforcement
IS432 (Part-1)	Mild steel & Medium Tensile bars and hard drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars
IS432 (Part 2)	Mild steel and Medium tensile steel bars and hard drawn steel wire for concrete reinforcement: Part 2 Hard drawn steel wire
IS 269	33 grade ordinary Portland cement
IS8112	Specification for 43 grade Ordinary Portland Cement
IS8041	Specification for Rapid hardening Portland cement

IS383	Specification for coarse and fine aggregate from natural source
IS12330	Specification for Sulphate Resisting Portland cement
IS 4353	Submerged arc welding of mild steel and low alloy steels recommendations
IS456	Code for practice for plain and reinforced concrete
IS800	Code of practice for general construction in steel
IS816	Code of practice for use of Metal arc Welding for General construction
IS817	Code of practice for Training and Testing of Metal Arc Welders
IS1182	Recommended practice for Radiographic examination of Fusion Welded Butt joints in steel plates
IS2595	Code of Practice for Radiographic Testing
IS3658	Code of practice for Liquid Penetrant Flew Detection
IS5334	Code of practice for Magnetic Particle Flaw Detection of welds
ASTM E 94	Recommended Practice for Radiographic Testing
ASTM E 109	Dry powder Magnetic Particle Inspection
ASTM E 138	Wet magnetic Particle Inspection
ASTM E 165	Liquid Penetrant Inspection
IS 3600	Methods of testing of Fusion Welded joints and Weld metal in steel
IS 483	Recommended practice for Radiographic inspection of fusion welded butt joints in steel pipes
IS 3589	Specification for seamless or Electrically welded pipes for water, Gas and Sewage
IS 6631	Steel pipes for Hydraulic purposes
IS 7343	Code of practice for ultrasonic testing for ferrous Welded Pipes and Tubular Products
IS 2598	Safety code for Industrial Radiographic Practice

IS 5822	Code of Practice for laying of electrically welded steel pipes for water supply
IS 1566	Hard drawn steel wire fabric for concrete reinforcement
IS 6419	Welding rods and bare electrodes for glass shielded are welding of structural steel
IS 1974	Bare wire electrodes for submerged arc welding
IS 7307	Approval tests for welding procedures
IS 7310	Approval tests for welders working to approved welding procedures
IS 2720	Methods of test for soils
IS 780	Specification for Sluice valves for water work purposes. (50 to 300mm size)
IS 2906	Specification for sluice valves for water work purposes (350 to 1200mm size)
IS 1916	Steel cylinder pipe with concrete lining and coating
IS 7322	Specials for steel cylinder reinforced concrete pipes
IS 11906	Recommended for cement mortar lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

6.3 Materials

Steel plates – The steel plates for pipes fittings, specials and stiffeners shall be of mild steel conforming to IS2062 Grade B, with no negative tolerances on the plate thickness

Cement – Ordinary Portland cement conforming to IS 269.

Aggregate – The aggregate shall confirm to IS 383

Water – The water used in preparation of concrete mix shall conform to the requirements of mixing water specified in IS : 456

Welding consumables – such as electrodes, filler rods and wires shall conform to IS 814, IS 3613, IS 6419 and IS 7280

When requested by the Engineers, the contractor shall provide test sample of the materials to be used in the works for testing. The cost of such tests shall be borne by the contractor and shall be included in his item rates.

6.4 Inspection

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the contractor of his responsibility to furnish materials and performed work in accordance with this specification.

The contractor will notify the engineer, in advance of the procurement of materials and fabrication thereof, in order that the employer may arrange for mill and shop inspection. The engineer may reject any or all materials or work that does not meet with any of the requirements of this specification. The contractor shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the engineer.

The Engineer shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of the work under this specification.

The contractor shall supply free of cost required specimen of materials for testing by the employer at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of engineer.

The contractor shall provide 2(two) sets of accurate “GO” and ‘No Go’ ring gauges to measure the diameter of pipes, specials and fitting for the use of the Engineer at no extra cost.

6.5. MS Specials

Specials shall be fabricated to the dimensions shown on drawings. Specials, such as tees, Y-pieces, bends, tapers, etc. shall necessarily be in steel and shall be in accordance with IS 7322/BS 534/AWWA C208 and ASME standards and tested and laid in the same manner as the pipes.

Standard fittings shall be used wherever possible in preference to fabricated fittings. Standard fittings shall be manufactured in accordance with standards above. Where fabricated fittings are supplied with approval of Engineers they shall be fully workshop fabricated and tested in accordance with above standards.

Tee and branches on steel pipelines must be reinforced by welding collars around the base of the branch and in the case of large diameter branches, increasing the main pipe wall thickness or making use of crotch plates. Unless shown otherwise on the drawings branches shall comply with the requirement of the following table:

Fitting Description Pipe work O.D. (mm)	Main Pipe wall Thickness (mm)	Branch Pipe Wall Thickness (mm)	Collar Details (mm)
324 off 1999 324 off 1999-	14/12	5.0	150 Wide x 14 to 25 Thick

1549 Taper 324 off 1999-Level Invert Tee 324 off 1647 324 off 1241	14/12 14/12 11/12 8/10	5.0 5.0 5.0 5.0	 150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick 150 Wide x 14 to 25 Thick

The fittings shall be designed and, if considered necessary by the Engineer, fabricated by a specialist contractor and the design calculations and drawings shall be submitted to the Engineer for approval. For oval shaped collars the width given in the above table shall be at the narrowest point. All other fittings, tees, branches, crosses and bends are to be designed by the fabricator.

Steel specials shall have the same chemical and mechanical properties and shall be compatible in all respects with the pipes with which they are to be used. The marking of pipes and fittings shall be as specified.

PART – 4. PIPELINE ANCILLARY WORKS

SPECIFICATION
PIPELINE ANCILLARY WORKS

7.1 DMA & Bulk Flow measuring systems

7.1.1 Introduction

The flow measurement system for DMAs and bulk flow measurement to be used under this contract shall be electromagnetic type meters with GPRS. Each water meter intended for district metering is for a potable water supply. It shall comprise two principal components, as follows:

- A flow sensor of the electromagnetic type, which shall be suitable for installation in a buried water main. The sensor shall be connected to the main by means of PN16 flanged connections. The meter shall be suitable for installation in a flooded chamber and for being directly buried.

- An electronic display unit. This shall be installed in an above ground cabinet enclosure in a convenient location, as close as possible to the water meter.

The water meter shall be powered by batteries which shall be integral to the electronic display unit. The batteries shall be capable of being replaced by the Employer's staff at site and capable of providing uninterrupted power supply at the specified voltage for not less than 3 years duration without battery replacement. The Contractor shall replace at no cost any batteries that fail or require routine replacement throughout the contract period.

Note: The contractor at the end of the defect liability period shall replace and install batteries for all flowmeters as per the original specification.

On a minimum, water meter shall be provided with the following facilities at the electronic display unit:

- integral real-time clock for date and time recording of flow data
- integral data logger for storing data for a minimum of 31 days.

0 Serial or suitable communication port to enable data to be passed from the display unit

1 to display flow and pressure details.

- a second serial or suitable communication port for the temporary connection of a laptop computer
- Input/output block for connecting GPRS transmitter for the transfer of all display /error codes and status functions from the electronic display unit

SCADA system, to be executed by the "other D2b contractor" or any other contract.

- For the Existing DMA water meters in the area, Contractor has to provide suitable Interface units along with its RTU's enabling the existing DMA water meters to transfer their data to SCADA Control room for UFW monitoring in totality through GPRS communication.
- Meters should be commissioned upon installation on a per DMA basis so as All data from the meter can be transferred to the UFW SCADA System being developed/installed by the Other D2b Contractor" or another contract as specified by BWSSB to enable monitoring of the completed Mandatory Works for the particular DMA. PSION and Laptop, leads and appropriate software and software licenses shall be provided to facilitate configuration of the water meters and for down-loading the integral data logger for data analysis.

7.2 General Specifications for Electro Magnetic Flow Meters

a) Full bore electromagnetic flow meter shall consist of flow sensor (i.e. flow tube), flow transmitter and flow indicator and integrator and any other item required to complete the system. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided, as required by the flow meter manufacturer and in line with the applicable standards. Contractor shall finalize the exact location of flow meter in consultation with Engineer.

b) Flow measurement shall not be affected by physical properties of water viz., temperature, pressure etc., within given limits. Contractor shall provide compensating electronic circuits, if required.

c) A lockable enclosure shall be provided for the flow transmitter cum computing unit.

d) Flow meters shall be suitable for the water turbidity at site during various seasons. Flow tube shall be rugged in construction and shall be suitable for continuous operation. Flow tube shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.

e). The flow computer and transmitter shall be a single unit suitable for field mounting. It shall accept inputs from flow tube process the signals and shall provide an output proportional to the flow rate. The output shall be 4-20 mA/HART/modbus

a) Particular Specifications:		
1.	Accuracy of flow measurement during	± 0.4% of measured value

a) Particular Specifications:			
	FAT		
2.	Overall accuracy of flow measurement loop.	± 1.0 % of measured value	
b)	**Flow tube**		
(i)	Application	:	Water applications
(ii)	Type	:	In line, full bore electromagnetic
(iii)	Size of flow tube	:	To suit mains flow parameters, with pipe reducers provided as necessary
(iv)	Process connection	:	Flanged
(v)	Weather Protection Class	:	IP 68 as per IS 13947
(vii)	Material of Construction:		
	Electrodes	:	Hastelloy C276
	Coil Housing	:	non-corrosive
	Flanges	:	Carbon steel
	Grounding ring	:	Hastelloy C276
(viii)	Flow tube Lining	:	*EPDM*
c)	**Flow Transmitter Unit**		
(i)	Type	:	Microprocessor based with facility to configure the ranges.
(ii)	Type of display	:	4 digit backlit LCD / LCD, for flow rate in m3/hr. 8 digit backlit LCD / LCD for totalized flow in ML • Display with 8 digits for main information. Index, menu and status symbols for dedicated information • Key for toggling through the information and reset customer totalizer and call-up function • Selectable default information and accessible menus: - Operator - Meter - Service - Data Logger
(iii)	Units of display	:	• Volume: m3 x 100, l x 100,G x 100, G x 1000, MG,CF x 100, CF x 1000, AF, Al, kl • Flow: m3/min, m3/d, l/s, l/min, GPS, GPH, GPD, MGD, CFS,CFM, CFH

a) Particular Specifications:			
(iv)	Input	:	From flow tube
(v)	Output	:	4-20 mA/HART/modbus DC (isolated) proportional to flow rate
(vi)	Power Supply	:	In built lithium batteries. batteries shall work on a minimum for 3 years without external AC/DC power supply
(vii)	Zero and Span Adjustment	:	Factory set Password protection of all parameters and hardware protection of calibration and revenue parameters.
(viii)	Weather Protection Class	:	IP 65 as per IS 13947, IP 67
(ix)	Battery backup for totalized flow Type Capacity Backup Time Data Protection:	:	Online 2.5 Mva Minimum 8 hours considering transfer of real time data to the central server, 2-way communication (minimum 10 polling intervals either way) with the central SCADA server established at BWSSB premises & totalized flow and other related data as required under this contract. • All data stored shall be stored in an EEPROM. Totalizers shall be backed up every 10 min, statistic every hour and power consumption and temperature Measurement every 4 hour. Minimum 31 days of data shall be stored in EEPROM. • Password protection of all parameters and hardware protection of calibration and revenue parameters.
(x)	On line diagnosis & program modification:		Required as following: Diagnostic • Continuous self-test shall include - Coil current to drive the magnetic field - Signal input circuit - Data calculation, handling and storing • Features - Alarm statistics and logging for fault analyzing

		- Electrode impedance to check actual media contact -Flow simulation to check pulse and communication signal chain for correct scaling - Number of sensor measurements (excitations) - Transmitter temperature (battery capacity calculation) - Low impedance alarm for change in media - Flow alarm when defined high flow exceeds - Verification mode for fast measure performance check - Statistic flow and consumption data - The meter shall be configured to accept the meter program modification from the central SCADA server via remote GPRS communication as and when required, transfer error codes to the server for fault analysis
(xi)	Wireless Communication Module	Redundant GPRS modem for Transmission of Process Flow & Totalized Flow data to SCADA system (Make of the Modem shall be of Approved Make List of Flow meters as per Clause No: -6.6)

7.2.1 The Flow Sensor

The sensor shall be suitable for being directly buried and shall have a degree of protection to IP 68 (NEMA6). The sensor shall have PN16 flanged end connections.

The sensor shall be suitable for an operating pressure of 16 bar gauge and a system test pressure of 25 bar gauge.

The metering tube shall be suitably lined to withstand abrasion of the fluid. The lining shall be EPDM and shall have been type-tested in an accredited laboratory and have been shown to be suitable for use in contact with potable water (UKWFBS listed).

The electrodes for sensing the voltage induced in the liquid shall be made of type Hastalloy C267.

The coil housing shall be fabricated from corrosion resistant material

capable of submerged or buried operation.

The sensor shall be supplied complete with a factory-fitted umbilical cable for communication with the electronic display unit. The cable length shall be determined by the contractor for each meter location, but shall be not less than 20 metres long so that it can be cut on site to suit the selected location for the electronic display unit. The construction of the signal connectors and cable shall protect the water meter from electromagnetic interference and shall be suitable for buried use and outdoor installation. The cable shall be protected by a suitably robust polyethylene sleeve to prevent accidental damage.

The Contractor shall provide all sundry items such as grounding electrodes and/or grounding rings necessary for satisfactory operation of the sensor.

7.2.2 The Electronic Display Unit

The enclosure of the electronic display unit shall have a degree of protection to IP 65 or better.

The display unit shall have a configurable password protection for accessing the flow meter menu.

The unit shall have LCD displays to show the following parameters, as selected by the operator:

- Cumulative forward flow
- Cumulative reverse flow
- Cumulative net flow
- Instantaneous flow rate
- Instantaneous velocity
- Minimum night flow
- Peak day flow
- Pressure
- Date and time

The user shall be able to configure the electronic display unit to display:

- Cumulative flow in m^3
- Flow rate in m^3/h or l/s
- Velocity in m/s
- Pressure in m or kg/cm2

There shall also be status indicators for each of the following conditions:

- Battery low
- Fault
- Empty pipe

7.2.3 Calibration:

The Electromagnetic flow meter shall be calibrated for the full flow range specified as per BS EN 29104 (Methods of evaluation of electromagnetic flow meters). The calibration method shall be either gravimetric method as per ISO 4185 (Measurement of fluid flow in closed conduits – weighing method).

The 'test bed' shall be accredited by national /international certifying authority. The Contractor shall produce accreditation certificates for the test facility and manufacturer calibration certificate for each flow meter, for the review by Engineer. The Contractor shall also demonstrate complete calibration on the test bed in the flow meter laboratory during witnessing of meters as per Clause 6.9. The flow meter shall be acceptable if the accuracy and repeatability is equal to or better than those specified.

7.3 Water Meter Operation & Performance

The accuracy, linearity and repeatability of each water meter shall be in accordance with the latest version of ISO 4064, Class C or better, and shall be maintained for an ambient and liquid temperature range of 0°C to 50°C. In addition, the water meter shall confirm to the below standards

- CEN EN 14154
- PED: 97/23EC
- EMC: EN 61000-6-3,
- EN 61000-6-2, EN 61326-1

7.4 Pressure Measuring Systems for DMA's, Slums and Other Pressure Points

A. Pressure Transmitters(sensors) for DMA's and Slums

Each pressure sensor shall be capable of operating in the range required, and be of the diaphragm type. It shall be provided complete with non-ferrous pipe-work, isolation valves, calibration valves and a surge damper device. Local and remote display units shall be provided. Pressure transmitters shall be designed for operation over 130% of full range. They shall be capable of withstanding surge pressures likely to occur in the monitored system.

(a) General Specifications:

(i)	Service	:	Pipeline, adjacent to electro-magnetic meter
(ii)	Quantity & Ranges	:	As per process requirements.
(iii)	Accuracy of measuring loop	:	± 0.25% of reading or better

(b) Pressure Sensor / Transmitter

(i)	Sensor	:	Diaphragm Sensor (internal)
(ii)	Material	:	SS 316
(iii)	Range	:	Adjustable over full span
(iv)	Zero and span adjustment	:	Required
(v)	Output signal	:	4-20mA, DC
(vi)	Ingress Protection of sensor	:	IP 68 of IS 13947 (Part I)
(vii)	Accessories	:	Isolation valves, Impulse tubing and all installation hardware

(viii)	Data Logger	:	Required
(ix)	Wireless Communication Module	:	Required
(x)	Dampening circuit	:	Required

Note: 1. Data Logger shall be inbuilt display unit with lithium battery backup for minimum 3 years without the external power supply

2. The battery shall provide power supply to pressure transmitter as well as wireless Communication module (GPRS Communication modem) for data transmission to SCADA center.

3. Data logger along with wireless communication modules shall be protected with a enclosure having minimum IP-65 rating.

4. 10% spares of the total supply shall be provided for the data loggers.

B. Pressure Data Loggers for Other Pressure Points

(i)	Service	:	Branch pipeline
(ii)	Quantity & Ranges	:	As per process requirements.
(iii)	Accuracy of measuring loop	:	± 0.25% of reading or better
(iv)	Sensor	:	Diaphragm Sensor (internal)
(v)	Material	:	SS 316
(vi)	Range	:	Adjustable over full span
(vii)	Zero and span adjustment	:	Required
(viii)	Output signal	:	4-20mA, DC
(ix)	Ingress Protection of sensor	:	IP 68 of IS 13947 (Part I)
(x)	Accessories	:	Isolation valves, Impulse tubing and all installation hardware
(xi)	Data Logger	:	Required
(xii)	Wireless Communication Module	:	Required
(xiii)	Dampening circuit	:	Required

Note: 1. Data Logger shall be inbuilt display unit with lithium battery backup for minimum 3 years without the external power supply

2. The battery shall provide power supply to pressure transmitter as well as wireless Communication module (GPRS Communication modem) for data transmission to central SCADA center.

3. Data logger along with wireless communication modules shall be protected with a enclosure having IP-65

4. 10% spares of the total supply shall be provided for the data loggers

7.5 Qualification Criteria for Instrumentation Supplier/Integrator for installation of Instrumentation.

The Instrumentation system integrator shall be operating under an accredited ISO 9001-2008 or above Quality System.

The instrumentation integrator should have minimum ten (10) years of

experience in India in the field of related/proposed instruments supply, installation and commissioning and service. They should have a branch locally for service support equipped with complete fault analysis equipment. The local service support branch should have been in operation for not less than 5 years at the time of bidding. No deviation on this clause shall be accepted. Bidders to note the importance of this obligation. Suitable references/documentation shall be provided at the time of bidding.

Additionally, the instrumentation integrator must submit evidence that they employ in excess of 30 personnel, including no less than 20 technical staff to include engineers, programmers, and field technicians.

Contractor shall submit the qualification and license for a minimum of ten (10) professional instrumentation/electronic engineers in the direct employment. Each engineer who shall be assigned to work on the project shall have minimum 10 years of experience in the related field and shall demonstrate the same. The CV of the engineer shall be submitted for review and approval before the same is mobilized to work on the project. The engineer who shall programme the SCADA shall have at least 15 years of experience in programming of SCADA systems and related wireless technologies.

The field technicians shall have a minimum of 10 years of related instrument installation and calibration experience. CV of the field technician shall be submitted for review and approval before the same is mobilized on site. No deviation on this clause shall be accepted. Bidders to note the importance of this obligation.

Contractor shall submit the qualification and license for a minimum of five professional engineers in the direct employ of the system supplier. Identify with resumes all personnel who may be assigned the specified project.

On a minimum, the professional engineer/programmers shall have a minimum of 15 years of related instrument installation and calibration experience and the field technicians shall have a minimum of 10 years of related instrument installation and calibration experience.
The resumes of the engineers, programmers & field technicians shall be submitted for the engineer’s approval before any commencement of instrumentation related work. Bidders to note the importance of this obligation.

7.6 Preferred Vendor list for DMA Flow measuring & Slum Bulk flow measuring Flow measuring & Pressure sensing systems:

The bidder shall provide references along with referee contact information for minimum of 10 similar projects or 50 nos where the proposed instrumentation (flow measuring & pressure measuring systems) have been successfully installed and commissioned. All the above projects should have completed a operation & maintenance period of minimum 5 years and above.

The naming of a manufacturer in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired. In order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service, to the greatest extent possible, like items

Sl No Description Vendor/Manufacture/Make 1 Flow measuring system (Water meter) M/s ABB

M/s Seimens
M/s Forbes Marshall
M/s Endress+Hauser 2 Pressure Transmitters/Sensing elements M/s Emerson

M/s ABB,
M/s Kobold
M/s Waaree
M/s Siemens
M/s Endress+Hauser 3 Data Loggers for Pressure Transmitters and Other Pressure Points M/s Seba KMT

M/s Masibus
OR Any equivalent

of equipment provided hereunder shall be the end products of one (1) manufacturer.

Note: In the event that the contractor wishes to propose alternate makes for the equipment mentioned above, he shall submit the following:

1. Demonstrate that the proposed makes are “Superior / Equivalent” to the above listed venders / makes.
2. Manufacturer involved in manufacture of specified equipment for at least 10 years before bid date
3. At least five (5) successful installations commissioned in last 5 years before bid date and satisfactorily operating for at least five (5) year before bid date
4. Manufacturer to provide full contact information for each reference as part of technical bid

7.7 Facilities for Configuration of Water Meters (EMF).

Each water meter shall be such that it can be configured using a laptop computer. The Contractor shall therefore provide within 6 months of the commencement date of the contract:

- 2 Nos lap-top computers
- 2 Nos flexible leads, each complete with any necessary associated components, to connect the lap-top computers to the water meter display units
- All software and software licences needed to configure the water meters.
- 2 Nos PSION with all accessories including optional item. Each laptop computer shall be of the latest configuration and incorporate:
- An Intel Centrino or equivalent 2 GHz dual core processor (or equivalent), or better
- 2 Gigabyte (GB) DDR2 Random Access Memory (RAM), or better
- hard disc with 320 Gigabyte memory, or better
- 15.4” TFT display
- DVD RW drive
- keyboard with English letters
- ports to enable the computer to be connected to a water meter electronic display unit, an external mouse, a printer, another computer and to a CD writer.
- at least two USB ports
- Wi-Fi (WIRELESS)

The following items shall be provided with each laptop computer:

- a mains power supply unit, complete with an appropriate main plug and leads, suitable for use with a 240V 50Hz single phase & neutral electricity supply
- cordless mouse
- a carrying bag

The Microsoft Windows 7 or later, operating system shall be installed on each lap-top computer, together any other software (licensed version) needed for the configuration of the water meter electronic display units and for communication with the data loggers. Two further copies of this software shall be supplied on CD-ROM.

The Contractor shall obtain software licences permitting the software supplied to be used simultaneously on two computers.

The above specification for computer hardware and software is indicative only. The contractor should take the approval of the engineer before commencing any design or purchase of the above-mentioned hardware and software. The above specifications shall be a integral part of the FDS submittal.-

7.8 Submissions by the contractor:

Functional Design Specifications: -**UFW Instrumentation**

The Contractor shall submit a complete functional design specification (FDS) for approval by the Engineer within 3 months of the award of the contract. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its control requirements. The Contractor is encouraged to obtain clarifications and to suggest refinements to the control descriptions contained in this Specification.

The FDS shall comprise an overall description of the UFW process, its functioning and control, and a detailed description of each section of the control system. The detailed description shall include a step-by-step control description which defines the function of each piece of equipment and each control action and interlock.

The FDS shall describe the 'fail-safe' features incorporated into the design for the event of failure or loss of an input signal affecting a control loop or process sequence.

The FDS shall describe control actions taken and monitoring functions which remain available during a power failure/battery failure, and any automatic controls or sequencing which take place during system start-up and shut-down.

The FDS shall be presented in a clear and precise manner and shall include figures or drawings where appropriate.

The Contractor shall submit and obtain approval of the FDS from the Engineer before beginning the detailed control system design. The contractor should take note of the importance of this obligation.

In general, the submissions of the UFW instrumentation system shall comprise the following as a minimum:

(a) The detailed technical data sheets shall be submitted for all online filed instruments to the Engineer for approval prior to the procurement.

A functional design specification (FDS) for UFW system. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its requirements.

The FDS shall include a detailed block diagram of the system with description of the scheme to be provided. The FDS shall include operational details of the UFW system.

The FDS shall include a description of the interface of Instrumentation system (Online Flow & Pressure) with D2b SCADA system/central SCADA system of BWSSB to be installed by other contractor.

The Contractor shall submit a preliminary FDS and obtain approval before the system architecture design is finalized or detailed design takes place. The Contractor shall formally notify the Engineer for approval of any amendments or additions to the approved FDS. The

final FDS shall be submitted for approval before submission of the factory acceptance test definition documents. The Contractor should take note of the importance of this obligation.

(b) Layout drawings for each piece of equipment fabricated or assembled by the Contractor,
showing the position of each component with required clearances where applicable, and with overall dimensions.
(c) Wiring diagrams indicating each component of the system and all wiring and cabling thereto, showing manufacturers, types, duties, ranges and nomenclature, with inputs, outputs, cable wiring and terminal identifications clearly marked.

(d) Complete input and output list giving type, circuit number, tag name, short description, outstation, database reference, associated field device, range (if applicable), critical/non-critical alarm status and the like.

(e) Description of quality control methods and approvals.

(f) Detailed works and factory acceptance test procedures.

(g) Program for manufacture, delivery, installation and commissioning.

(h) Appendices, as necessary, to include manufacturer’s literature for each item of equipment supplied.
(i) Operation and maintenance manuals detailing the following:
a. General description and operating principles;
b. Technical description of the equipment (manufacturer’s standard brochures only being acceptable if the particular item of equipment described is clearly designated, adequate information is supplied, and irrelevant information is deleted or otherwise delineated)
c. Complete operating instructions defining the sequence of operations, including flow charts;
d. Procedures for dismantling, cleaning, servicing, replacing parts and reassembling, including recommended clearances and tolerances;
e. Details of all instrument and equipment settings as applicable to this contract;
f. Maintenance and lubrication schedules;
g. Fault diagnosis procedures;
h. Dated and priced list of significant spare parts and special tools, including identification numbers and sources of supply;
i. Simplified arrangement drawings showing all components of the equipment.
(j) General operating manual comprising the following:
a. General description and operating principles;
b. Operating instructions for normal procedures in a step-by-step format including control operations, requirements for display or printing of data, performance monitoring, response to alarms or failures, changing of operational parameters, and manual data entry.

7.9. Factory Tests & Inspection

Each water meter shall be subjected to a hydrostatic test and shall be calibrated in the manufacturer's works prior to dispatch. Calibration and hydrostatic test certificates and QAP shall be provided with each meter prior to the inspection for approval.

The contractor shall arrange for witnessing factory tests of the meters for engineers at the manufacturing facility or if Manufacturer doesn't have Calibration facility in India, the contractor shall arrange calibration test in any of local Flow meter Laboratory accredited by national /international certifying Authority for minimum of 10% of varied sizes of meters and a minimum 1no for each size/diameter proposed in this contract., as per equivalent BS standard for method of calibrating the electromagnetic flow meter by gravimetric method. If found any defective or not meeting the accuracy's & other parameters in that 10% of varied sizes then the entire lot shall be treated as rejected. Bidder shall note the importance of this obligation.

7.10 Installation

(a) Flow Sensor and Electronic Display Unit

Every electromagnetic water meter shall be installed in accordance with the manufacturer's instructions and recommendations. In particular, the sensor body shall be installed such that it is always full of water to ensure full bore meter operation at all times, even during periods of intermittent supply, and with the electrodes always submerged. This may be achieved by utilizing natural dips in the pipeline, re-laying existing pipes with deflections at joints to create the necessary installation conditions, or creating a low point for the sensor body. Pipe transition slopes shall be such as to ensure any debris suspended in the flow of water is carried through the meter without any deposition. Pipe reducers shall be used to minimize excavation depths and pipework modifications. A slab or plate shall be buried above the sensor to warn other contractors of its location beneath and to provide appropriate protection.

A sluice valve shall be provided at a suitable location downstream of the meter, or a nearby sluice valve in the distribution network may be used, to stop flow through the water meter to enable zero checks to be made. The payment for sluice valve is not included in item 2.9 and 2.10 of bill of quantities and any sluice valve installed will be paid separately under item 2.5 of bill of quantity.

Wherever a water meter is to be installed in a water main with cathodic protection, insulating flanges shall be provided on both sides of the sensor and insulated copper straps shall be installed to provide electrical continuity between the pipes on each side of the sensor.

The electronic display unit shall be installed on a removable backboard in a vandal-resistant weatherproof IP65 floor, wall or post mounting cabinet enclosure. The enclosure shall be constructed from galvanised steel which is at least 3 mm thick. The enclosure shall have a hinged access door,

which shall have a facility for padlocking in the closed position. Batteries shall be easily accessible for periodic changing. For floor mounting enclosures, the enclosure shall be mounted on a concrete plinth, the surface of which shall be at least 150 mm above the surrounding finished ground level. A cable duct shall pass through the plinth to enable the cable from the flow sensor to enter the enclosure. A label showing details of the Employer's name and the water meter's unique reference number shall be fixed to the external face of the access door. Contractors or equipment manufacturers details shall not be fixed to the external face of the access door.

The enclosure shall be well-ventilated, dust-proof and vermin-proof, and be suitable for robust use in a tropical climate. It shall also be suitable for:

- the housing of the integral data logger and the temporary housing of a battery powered data logger which could periodically be used in conjunction with the water meter
- the permanent housing of any lightning protection system
- the permanent housing of GPRS transmitter and battery pack, and any other items necessary to facilitate communication with the SCADA system.
- mains pressure recording - see (b) below

Except where the cable is underneath the concrete plinth, there shall be a minimum of 500 mm cover for the cable. The cable shall be surrounded by a sand bedding at least 75 mm thick and interlocking cable protection tiles shall be installed above the cable. An 'electric cable' warning tape shall be installed above the tiles. Wherever practicable, the cable shall be installed at least 600 mm away from any other cables.

Details of the sensor, including its diameter and the size of main together with a unique reference number, shall be permanently indicated on the outside of the cabinet enclosure housing the electronic display unit. A laminated copy of the DMA record plan shall be installed in each DMA meter cabinet enclosure for that DMA.

As flowmeter installation and commissioning progresses, a selection of 20% of the DMA meters shall be check-calibrated in situ to verify that the meter accuracy is unchanged and installation arrangements are satisfactory. If any check-calibration results are unsatisfactory, all DMA meters

shall be check-calibrated. No payment will be made for such check-calibrations or for any undertaken subsequently during the contract period.

(b) Pressure Monitoring

A pressure tapping (see service connections below) shall be made in the pipeline adjacent to the electromagnetic district meter for pressure monitoring. A pressure transducer shall be connected to the pressure tapping, with the connector and signal cable sealed to IP68 standard. The pressure signal cable shall either be integral with the meter signal cable or

bundled with it and connected to the electronic display unit in the steel cabinet enclosure through a protective PE sleeve. Wherever the protective PE sleeve is above ground it shall be further protected, for example by installing it within mild steel pipe or, if the enclosure is post mounted, within the post itself.

7.10.1 BWSSB Bulk Flow Metering & Monitoring Project

BWSSB has taken up installation of Bulk Flow Meters in many areas as part of UFW ministering and calculation. BWSSB has recently awarded a contract to M/S Chetas Control Systems Pvt. Ltd., for the supply, delivery, installation and commissioning of flowmeters ranging in size from 100mm up to 600mm to monitor flows on the existing water transmission and primary distribution feeder mains network. Under that contract, the meters will have GPRS communications connectivity to the BWSSB Central SCADA / UFW-D2b SCADA.

The contractor shall utilize these meters as DMA meters with the approval of the Engineer. The information is available at GIS as well as the same shall be obtained from offices of BWSSB, Additional Chief Engineer – NRW Zone.

7.11 Particular Requirements for Field Instruments and Communication Equipment

The Contractor shall commission and make operational the field instruments and communication equipments upon installation on a per DMA basis so as to monitor the performance of the mandatory works. Please note that the Contractor has to bear all communication costs including internet and any other cost during the construction period and defect liability period.

7.11.1 GPRS Communication Equipment:

The contractor shall provide the GPRS Communication Modem for each and every online field instruments (Flow, Pressure).The respective supplier of the online Field Instruments (Flow& Pressure) have to supply its own make of GPRS Transmitter & its related hardware’s along with its Instrument. The Contractor should note the importance of this clause.

7.11.2 Transferring Field Data to SCADA System:

Scope of work for Interoperability Test & Integration with the central SCADA server/UFW SCADA server (D2B contract):

A- Introduction:

BWSSB has setup a centralized SCADA server (MIS-2 contract) and centralized UFW SCADA servers to monitor flow data in real time basis. Both of the above SCADA servers are located at Shimsha Bhavan, Jayanagar, Bangalore at present.

Currently the UFW SCADA server monitors bulk meter data from UFW D2B contracts, D1A & D2A contracts and the MIS-2 SCADA server monitors real time data from water treatment & distribution network and sewerage networks.

UFW SCADA server is currently programmed to integrate data from other contracts in voltage format .i.e. all data to be received at the front end servers are mapped in voltage format .The system receives the data in this data format and then internally converts to the desired format required for onward display and monitoring by the SCADA system.

B- Scope of Work for Integration:

As part of this current contract, the contractor's scope of work on a minimum shall include to transmit the data from each bulk meter to the central server via wireless redundant communication link (GPRS). During detailed engineering (DDE), the final integration server (central SCADA server/UFW SCADA server (D2B contract)) tie in point shall be finalized between BWSSB and the contractor for the data to be transmitted to the central server.

As part of scope of work in this contract, the contractor shall conduct a interoperability test to confirm & demonstrate that the data from the bulk flow meters can be received & transmitted by the central SCADA server/UFW SCADA server (D2B contract) using appropriate OPC server & client software. The test shall be carried out in presence & co-ordination with the central SCADA server/UFW SCADA server (D2B contract).

The contractor shall note that the bulk flow meter data which is to be transmitted to the central SCADA server/UFW SCADA server is to be mapped / programmed in the same format as required at central SCADA server/UFW SCADA server for integration. Ensuring that the data is as per the format required by the central SCADA server shall be part of integral scope of work of the contract. The contractor shall be responsible for the availability of bulk flow meter data at the integration Front end processor servers (FEP) end at all times. Contractor shall note the importance of this clause. Integration of this data in to the SCADA system and display of the same in the SCADA system shall be under the scope of the central SCADA server/UFW SCADA server (D2B contractor).

The contractor shall be responsible for the instrumentation system in transferring their data from various online field instruments including AMR data to D2b SCADA System set up at Cauvery Bhavan by another Contractor.

7.12 SPARES.

Contractor shall provide all the services and supplies in accordance with approved procedures for handling of spare parts, which shall include

arranging for their proper receipt, stacking and storage.

(a) Spares: Contractor shall identify, define, procure, and supply of one (10%) Redundant GPRS modem

Note: Contractor to include Spare list during their bid submission based on the manufacturers recommendation for each item of equipment proposed.

7.13 Factory acceptance test documentation

As a minimum, the following information shall be included in the factory Acceptance test manual for each test:
a. Test identification number;
b. Test name and description;
c. List of all equipment to be tested including any special test equipment required;
d. Description of the test procedure broken down into logical steps;
e. Description of the expected system response verifying the completion of each logical step;
f. Space for recording the results of the test and the time and date of the test;
g. Space for signatures of the Contractor and the Engineer. In addition, the Contractor shall
provide a method for recording and tracing all problems, discrepancies, queries and
suggestions regarding the system and software, and for formalized control of any
modifications to the system.

7.14 Commissioning: Site Acceptance Tests (SAT) The Contractor shall submit all relevant draft operating manuals for the online field Instruments to the Engineer for approval prior to commissioning tests. Any faults or failures of the system detected during the previous tests shall be noted and corrected to the satisfaction of the Engineer before commissioning is allowed to commence.

As part of commissioning, the online Field Instruments and communication with the central SCADA server shall be tested for availability for a continuous period of sixty (60) days. During this period, the system will perform the normal functions according to the procedures described in the SAT documentation approved by the Engineer.

The system shall have passed the SAT if all major components have been free from fault or failure and exhibit full error-free functionality for 100 % of the total duration of the test, unless otherwise agreed by the Engineer. Major components include all master station equipment, outstations, and communications facilities.

During SAT, no modifications to the system shall be made by the Contractor without the written approval of the Engineer. Erroneous

functioning which requires software modifications or re-configuration to correct, other than set-point or parameter changes, shall constitute a failure of the availability test. Any changes to the system which are required and approved shall be described in a system-modification document, signed by both Contractor and Engineer and the document shall be incorporated into the final test documentation. The test shall be restarted after corrections have been made.

Interoperability Test & Integration co-ordination:

The contractor shall conduct a interoperability test to confirm & demonstrate that the online field instruments including AMR data can be read by the Central SCADA/D2b SCADA System package created by others. The test shall be carried out in presence & co-ordination with the D2b SCADA system contractor/system integrator.

It is required that the contractor maps his data for integration in the same format as required at Central SCADA / D2b SCADA system.

The contractor shall co-ordinate fully with the Central / D2b SCADA system contractor for integration tests. The contractor shall be fully responsible for data to be made available to the D2b contractor responsible for integration. Contractor to take note on the importance of this requirement.

7.15 Quality Assurance/Quality Control (QA/QC):

QA/QVC shall comply with the Contract, with particular requirements specific to the equipment or service being provided as outlined below for SCADA systems. The quality assurance/control procedures shall include, but not be limited to the following:

a. Continuity and Wiring tests;
b. Insulation and High Potential Testing;
c. Packaging and Shipping;
d. Welding;
e. Cleaning and Painting.
f. The quality assurance/quality control documentation shall include, but not be limited to the
following:
g. Material Certifications;
h. Shop Test Reports;
i. All other documentation required by applicable codes and standards.

7.16 Training Requirements:

The Contractor/ system supplier shall conduct training courses for personnel selected by BWSSB. Training shall be conducted by personnel employed by the Contractor/ system supplier familiar with the system supplied and who have experience and training in developing and implementing instructional courses. The entire cost of the complete training programme, including reasonable per diem expenses to cover meals, lodging, transport and similar expenses for

all BWSSB personnel attending the training program, shall be the responsibility of the Contractor/ system supplier and shall be included in the contract price.

The Contractor/ system supplier shall submit information on the training programme for approval, prior to shipment of the equipment. This submittal shall include a course outline; time required, course schedule, sample workbook and instructor qualification information for each level. The Contractor/ system supplier shall make a workbook on each course available to every person taking the courses listed herein. The workbook shall be of sufficient detail so that, at a later date, a trainee could review in detail the major topics of the course.

The training times shall be scheduled by the BWSSP in advance with the Contractor/ system supplier.

a. Operations and Maintenance Training

Training shall be provided for five (5) of the BWSSP personnel at the Contractor/ system supplier facility on operations and maintenance of all system components. The training program shall be divided into two segments and shall consist of at least 5 (five) working days, each of 8 (eight) hours duration. Training shall be provided after completion of SAT. The maintenance training program shall be developed for personnel that have electronics maintenance and repair experience and a general knowledge of computer systems, but shall not assume any familiarity with the specific hardware furnished. As a minimum, the following subjects shall be covered:

•a o System Architecture and Layout
•b o Wireless communication
•c o Hardware Components
•d o Power Supplies
•e o Data Highway:
•f o IOP programming and diagnostic techniques
•g o Battery replacement and recharging
•h o Troubleshooting
•i o Disassembly
•j o Cleaning
•k o Component Replacement
•l o Re-assembly
•m o The operation training programme shall include the following topics:
•n o Power-up, bootstrapping and shutdown of all hardware devices
•o o Interpretation of all standard displays
•p o Appropriate actions for software and hardware error occurrences
•q o Use of operator interface displays and keyboards
•r o Use of printer including replenishment of supplies
•s o Manual data entries
•t o Creation and editing of graphic operator display screens.
•u o Loading of any required software into the system
•v o Data base creation and editing.

7.17 Technical Documentation

The following technical documentation shall be provided for the water meters and associated items: This shall be read in conjunction with **clause 7.1.10**

(a) A list of all parts of the water metering system which are to be supplied loose.
(b) Dimensioned general arrangement drawings for the steel enclosures that are to house the
electronic display units (internal and external – for approval and final versions).
(c) Manufacturer's technical brochures for the water meters and lap-top computers,
together with installation, operation and maintenance instructions, parts lists and lists
of recommended spare parts (if any).
(d) The software licenses.
(e) Manuals for all the software supplied.
(f) Constructional and connection details of the cable linking the sensor to the electronic
display unit.
(g) Type test, factory hydrostatic test and factory calibration certificates.
(h) Installation drawings showing the locations of all separate components of the water
metering system.
(i) Site commissioning records.

7.18: Consumer / Domestic Portable Water Meters.

Consumer water meters (Class B Multijet) from 15mm to 40mm shall be issued from BWSSB Central stores. An indent will be issued from Engineer to Central stores and the meters shall be drawn and same shall be handed over to the contractor for fixing. The stores issue rates shall be met out from the provisions made in the main estimate under Provisional Sum.

The released old meters shall be handed over to respective O&M Service Stations.

Consumer / Domestic Bulk Potable Water Meters for sizes above 50 mm with AMR
Facility:

Supply & delivery at site, erection, testing, trail run and commissioning of brand watrer meters conforming to IS 2373-1981 / ISO 4064/1 with latest amendments or equivalent standards as per the directions of the Engineer. The water meters shall be equipped with Automated Meter Reader (AMR) for remote meter reading / billing and the AMR shall be compatible with the data collection / SCADA system being installed by D2b contractor or to the Central SCADA established by BWSSB.

The AMR water meters shall be from the preferred reputable manufacturers or equivalent such as **Zenner, Elster, Itron, Baylan, Woltman etc**. The contractor shall obtain vendor approval from BWSSB for the water meters offered.

The head loss through the meters shall be minimum possible for the size as per IS/ISO standards. The accuracy of the meters shall be +/- 2%.

The meter counters shall be tamperproof and provided with IP68 sealing.

. **Material of Construction**:

- Casing & Body – Cast Iron – Grade 20 of IS 210-1970, Minimum FG 250 Coated with a potable water approved Epoxy Coating
- Screw and Studs – Stainless Steel 07Cr18Ni19 of IS 6911:1992
- Strainers – HDPE
- Impeller Shaft – Stainless Steel 07Cr18Ni19 of IS 6911:1992
- Strainer: Built in or External and material of construction is HDPE
- Spindle and Bearing - Stainless Steel, 07Cr18Ni19 of IS 6911:1992
- Body shall with stand minimum pressure PN 10 bar

Connections:

Flanged end Dirt Box of suitable size Behaviour in case of flow reversal: Meters which may be subjected to an accidental reversal of flow shall be capable of withstanding it without any deterioration or change in their metrological properties, and at the same time shall record such a reversal.

Sealing:

Water meters shall have protective devices which can be sealed in such a way that after sealing, both before and after the water meter has been correctly installed, there is no possibility of dismantling or altering the water meter or its adjustment device without damaging the protective devices.

In addition to this, apart from sealings provided by the meter manufacturer for the meters, additional sealings to be provided connecting the meter couplings while fixing the consumer meters at site to avoid tampering of connections and to avoid unauthorized consumption of water by the consumer.

Meter markings: The water meter shall be marked with the following identifications:

- Direction of water flow with an arrow indicating the direction
- Trade mark and / or name of the manufacturer
- The metrological class and Qn rate in m3 per hour
- The manufacturer’s serial number of the meter permanently affixed to the meter’s upper

or lower case.
- Stamped with the initial “BWSSB”
- Working pressure
- Approval marking and no. of approval certificate
- Year of manufacturing printed on the counter or engraved the head ring
- Minimum sustainable pressure shall be PN 10 bar

Flow rate: Minimum, maximum and transition flow shall be as per relevant standards.

AMR - AUTOMATED METER READER

The Automated Meter Reader (AMR) shall be able to remotely read and monitor the metered consumption of water.

The automated meter reading capability shall reduce labor costs, improve meter reading accuracy, facilitate the provision of hourly water consumption data, and leak and tamper detection. The AMR system offered shall be compatible with water meter provided above, and provide remote meter readings by a suitable signal to a data collection / SCADA system. The AMR shall also be compatible with the data collections at Central ACADA / D2b SCADA system. The contractor has to liase/co-ordinate with SCADA contractor of D2b contract or Central SCADA for compatibility.

The AMR shall be battery operated with alarms to replace the battery when the battery is old or develops a defect. The battery shall be available from local supplier within India and has been available for more than 2 years. The life of the battery shall not be less than 5 years.

The AMR shall have adequate memory to store meter readings for up to 3 months and shall also have integral real-time clock.

The functions of AMR shall be as follows:
- Accurate remote meter readings and billing,
- Ability to do accurate water balances and so account for all water consumption,
- Reduce gap between consumption and revenue collection,
- Accurate Estimates

7.19 Service Connections: The House Service Connections shall be made with **Cpvc** pipes and specials manufactured as per IS; 15578/2007.

CPVC MATERIALS

The material used in the manufacture of the pipe shall be a rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1, with a Cell Classification of 23447 as defined in ASTM D1784. This compound shall be light grey in colour as specified, and shall be approved by NSF use with potable water.

DIMENSIONS

CPVC Schedule 40 & Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM F441 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to this standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM F441. All belled-end pipe shall have tapered sockets to create an interference type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672. This pipe shall have a flame spread rating of < 25 and a Smoke Development rating of < 50 when tested for surface burning characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.

7.19.1 Strap/Clamp Saddle

General Specifications:

Strap Saddle for service connection from water distribution mains shall be of wrap around design, wide skirt and wide straps support, which shall reinforce the pipe while providing excellent stability to the saddle.

Saddles for service connections shall be of fastened strap type with threaded outlet for service connection. The service connection threading sizes shall be conforming to IS: 554
Saddles shall be suitable for DI pipes of nominal size 4” (NB 100) to 12” (NB300) with nominal service connection size from ½” (NB 15), ¾” (NB 20), 1” (NB25), 1 ¼” (NB 32) and 1 ½” (NB 40).

The straps shall be elastomer coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the un-identical metals. The saddles shall be single strap type up to pipe sizes of NB 300 and service outlet of ½”, ¾” and 1” and double strap type when the service outlet is 1 ¼”, and 1 ½” .

Fasteners shall be of threaded nut-bolt-washer type. Nut-bolts of size ½” (M12) shall be used for saddles of size for 4” (NB 100) and Nut-bolts of size 5/8” (M16) shall be used for saddles of size 6” (NB 150) and above.

The sealing between the saddle and mains shall be obtained by using a profiled elastomer seal matching to the curvature of the pipe. The seal shall be of elastomer type, suitable for all potable water applications.

The Material of construction of the body, straps, fasteners etc. shall be of a non-corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both.

The design of the saddle body should be such that, the service connection outlet metal insert shall project out towards pipe side and align with the hole drilled on the pipe to ensure positive locking against rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

The clamp saddles shall be suitable for maximum working pressures upto 10 bars.

Material and Design Specifications:

Saddle Body: Non-corrosive Engineering Plastic body moulded with Stainless steel threaded metal insert for tapping outlet. Also, the stirrup metal plate shall be duly embedded in the plastic body, except at the place of nut-bolt lugs. Threading size and dimensions shall conform

Note: The 'MDPE' as mentioned in the above drg. shall be read as 'uPVC'.

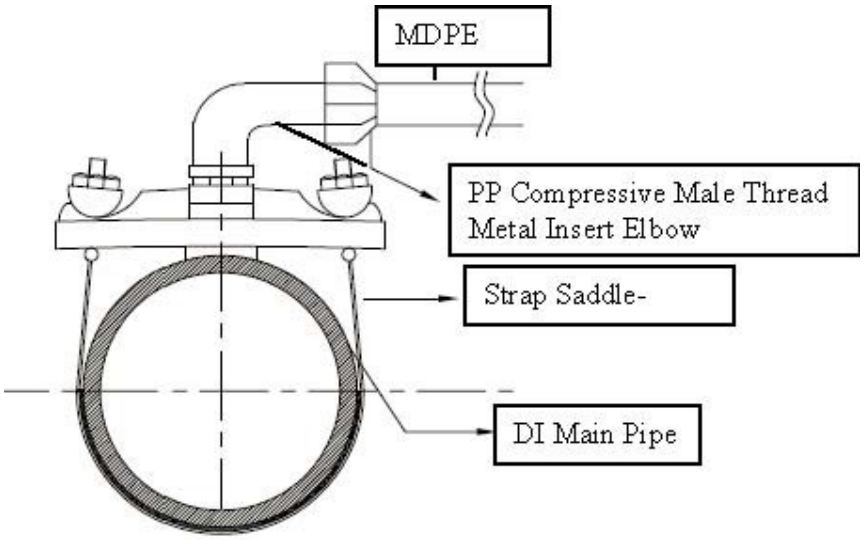
to IS: 554. The body shall have retaining cavity housing for internal and external retention of the elastomeric seal. Sealing shall be achieved by pressure exerted by the body while fastening the saddle straps & body on the pipe.

Saddle Strap: Saddle straps shall be made of stainless steel 304 grade to prevent corrosion over the long service life. Strap Insulation: Elastomeric (rubber) insulation / lining shall be such that none of the Stainless-Steel Strap is in direct contact with the pipe. It shall ensure a firm non-slip grip mounting on the pipe to prevent the saddle from rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

Saddle Seal: It shall be virgin rubber SBR Grade 30 / NBR (NSF 61 approved). It shall be of type pressure activated hydro-mechanical design. It shall be contoured gasket to provide a positive initial seal which increases with increase in the line pressure. Gasket shall be gridded mat, with tapered ends, with the outlet section having 'o' ring contacting the saddle body multiple o-rings contacting the pipe, preferably with a Stainless-steel reinforcing ring insert moulded to prevent expansion under pressure.

Nuts-Bolts- washer: Stainless Steel Type 304, NC rolled thread, Tightening torque for ½" (M12) nut-bolt: 14-15 kg.m and **for 5/8" (M 16) nut-bolt: 21-23 kg.m**
The general arrangement of Strap Saddle with PP Compressive Male Thread Metal Insert Elbow is shown below;

The joints in service connection between Cpvc pipe and UPVC Ball Valve and the Water Meter shall be tamper proof / not easily dismantled by the Consumers as directed by the Engineer.



7.19.2 Ferrule Materials

Compression fittings for house service connections shall comply with ISO 14236, with
materials of construction as per clause 5 in the Standard as follows: Body – polypropylene
Nut/cap - polypropylene Clip ring - POM (acetylic resin) Packing bush - polypropylene “O”
ring - NBR Threaded metal inserts - SS304 with BSP threads

For clear identification of water services, fitting nuts shall be coloured blue and the body black. All threads shall be BSP.

The dimensions of compression fittings shall be in accordance with clause 7.1 of ISO 14236. The pressure rating of compression fittings shall be PN16 as per clause 8 of ISO 14236. Performance testing shall be as follows:

Clause 8.2.1 Leak tightness under internal pressure Clause 8.2.2 Resistance to pull-out Clause 8.2.3 Leak tightness under internal vacuum Clause 8.2.4 Long term pressure test for leak tightness for assembled joint Clause 8.3.2.1 MRS value as per ISO 9080 Clause 8.3.3.1 Resistance to internal pressure All materials or components coming into contact with potable water shall comply with the following: Metallic components shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odours or discoloration.

- Non-metallic components shall be approved as being free from adverse health effects.

Compliance with national or international standards shall be

demonstrated by
production of appropriate third-party certification.

Compression fittings for the conveyance of water for human consumption shall conform to BS 6920 for the effects on water quality, and certificates demonstrating compliance with the following parameters shall be provided: odour and flavour of water, appearance of water, growth of micro-organisms, extraction of substances that may be injurious to public health (cyto toxicity), and extraction of metals.

7.20 Flexible Couplings and Flange Adaptors

Slip-on type couplings shall include the following couplings:

(i) straight flexible couplings;
(ii) stepped flexible couplings;
(iii) flange adaptors.
(iv) dismantling joints

The pressure rating of the couplings shall be suitable for 16 bar working pressure and a test pressure of 24 bar.

The preparation of pipe ends for slip-on type couplings shall be in accordance with the requirements of and the tolerances specified by the joint manufacturer. Couplings shall be installed fully in accordance with the manufacturer's recommendations.

All couplings shall be supplied with transit protection.

7.20.1 Flexible Couplings

Flexible couplings shall be of the steel bolted compression ring type in accordance with AWWA C219.91, capable of allowing flexibility of the joint and removal of the attached pipework. Unless indicated all couplings shall be supplied without the central register.

Protection, both externally and internally, shall be a nylon coating in accordance with UK WIS 4-52-01: Part 1.

7.20.2 Flange Adaptors

Flange adaptors shall be of a bolted compression ring type in accordance with AWWA C219.91, allowing flexibility of the joint and removal of the attached flanged pipework.

They shall be given nylon coating in accordance with UK WIS 4-52-01: Part 1.

7.21 Pipeline Marker Tape

All pipelines installed by open trench methods shall be marked with an acid and alkali resistant polyethylene detectable warning tape with a minimum width of 300 mm. The tape shall be blue in colour and clearly marked in black lettering with “CAUTION -WATER MAINS BELOW” in both English

and Kannada with a maximum repeat distance between each text along the tape of not more than 1 m. The tape shall be placed during backfilling of the pipeline trench at a depth of 500 mm below the finished ground level. The tape shall have a minimum strength of 125 kg/sq.cm in the longitudinal direction and 105 kg/sq.cm transversely. The minimum thickness of the tape shall be 0.5 mm.

Where the pipeline is non-metallic, the tape shall incorporate a metallic conductor of aluminium foil having a width of not less than 50 mm and a thickness of not less than 10 microns. The foil shall be totally enclosed within the polyethylene laminate such that the edges of the foil are totally protected against corrosive attack. The aluminium foil strip shall be detectable from the ground surface using a buried cable locator. The manufacturer of the tape shall provide methods for joining and terminating the tape, to enable a low resistance connection to be made to the aluminium foil. Electrical connection points shall be made at each chamber along the pipeline route.

7.21.1 Pipe Repair Clamps

Pipe repair clamps shall be CI body with gasket cemented to the clamp body. Double section clamps shall be installed:

• where the outside diameter of the pipe being repaired is outside the range of a single
section clamp (for pipes up to 200mm nominal
diameter)

• on pipes with a nominal diameter greater than
200mm.

Clamp bodies shall be given a nylon coating. The gasket shall be approved for use with potable water and shall be capable of resisting extreme climatic conditions, petrol, oil, gas and water.

Clamps shall be suitable for providing a permanent repair of damaged ductile iron and cast iron pipes, from pin-hole leaks to full 360° circumferential breaks. Leaking service connection ferrules may be repaired with boss type outlet connection single or double section pipe repair clamps.

Clamps shall be supplied complete with brackets and captive bolts with self–stabilising finger brackets to prevent bolt bending.

The pressure rating of the clamps shall be suitable for 10 bar working pressure and a test pressure of 15 bar.

The preparation of the pipe barrel prior to installation of the clamp and its outside diameter shall be in accordance with the requirements of and the tolerances specified by the clamp manufacturer.

Joint repair clamps

Clamps shall be installed fully in accordance with the manufacturer's recommendations.

Joint repair clamps shall be made of cast iron or ductile iron body to BS 2789 Grade 420/12 with Nitrile interlock gasket supplied to fit pipe outside diameter.

The gasket shall be approved for use with potable water and shall be capable of resisting extreme climatic conditions, petrol, oil, gas and water. Clamps shall be supplied complete with brackets and captive bolts with self–stabilising finger brackets to prevent bolt bending.

The pressure rating of the clamps shall be suitable for 10 bar working pressure and a test pressure of 15 bar.

The preparation of the pipe barrel prior to installation of the clamp and its outside diameter shall be in accordance with the requirements of and the tolerances specified by the clamp manufacturer.

7.22 Valves

7.22.1 General

Valves shall be as per internationally recognised standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504. All valves shall be PN 16 rating with PN 16 flanges.

Valves, with the exception of service connection valves, shall be double flanged types and the face shall be parallel to each other and flange face should be at right angles to the valve centreline. Backside of valve flanges shall be machined or spot faced for proper seating of the head and nut.

Valves buried or installed in an underground chamber, where access to a hand wheel would be impractical, shall be operated by means of an extension spindle and/or keys.

Valves of diameter 450 mm and above shall be provided with lifting eyes and shall have detachable bolted covers for inspection, cleaning and servicing.

Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.

The valve stem, thrust washers, screws, nuts and all other components exposed to water shall be of a corrosion resistant grade of stainless steel. Valves shall be free from sharp projections.

Butterfly and non-return valves shall be provided with a bypass arrangement. This may be integral with the valve or connected between pipes.

Wherever required, valves shall be housed within chambers as per

Drawing as per approved drawing.

7.22.2 Sluice Valves

Sluice valves shall be resilient seated and generally conform to IS 14846 / BE EN 1092 – 2 / AWWA C 509 / DIN 3352 or relevant internationally recognised standards.

Component MaterialBody / Dome / Bonnet SG Iron IS 1865 Gr. 500/7 Wedge SG Iron IS 1865 Gr. 500/7 (food grade quality)with EPDM encapsulatedStem (non – rising) SS 410 Wedge Nut Bronze Bonnet Gasket EPDM Gland seal O-ring EPDM

They shall be of the non-rising spindle type and shall close in a clockwise direction. Resilient seated sluice valves should be glandless.

All valves, spindles and valve key caps shall be positioned to give good access for operational personnel.

a). The body and bonnet of the valve should be of ductile Iron of grade GGG50.
b). The Wedges should of EPDM chlorination resistant rubber with NFS /WRAS
approval.
c). The Wedge Nut shall be fully integrated part of the wedge.

Materials of construction: The size of valves and pressure ratings are to be as per the Bill of Quantities. The Contractor shall provide test certificates for materials, strength and leakage shall be in accordance with BS 5150/IS 780.

7.22.3 Air Valves

Air valves shall conform to IS 14845 or relevant internationally recognised standards.

The air valve shall be capable of exhausting air from pipework automatically when being filled, the air being released at a sufficiently high rate to prevent the restriction of the inflow rate. Similarly, the valve shall be capable of ventilating pipework automatically when being emptied, the air inflow rate being sufficiently high to prevent the development of a

vacuum in the pipelines. The valve shall also automatically release air accumulating in pipework during normal working conditions.

Air valves shall be of the double chamber, double orifice type with a large orifice for air entry into the pipeline and smaller orifice for automatic release of air under normal working pressure. The valve shall be suitable for the maximum working pressures in the system. All air valves shall be provided with an isolating valve and flanged end connections.

Air valves shall be designed to prevent premature closure prior to all air having been discharged from the line. The orifice shall be positively sealed in the closed position but the float (ball) shall only be raised by the liquid and not by a mixture of air and liquid spray. The seating shall be designed to prevent the floats sticking after long periods in the closed position.

Air valves shall comprise a cast iron body having faced and drilled flange at inlet and with two chambers each housing a ball. One chamber shall have a small orifice and the other a large orifice. Balls shall be of stainless steel only.

Materials of construction:

Component	**MOC**
LP / HP chambers	CI IS 210 Gr. FG 260
LP seat ring	Gun Metal IS 318 Gr. LTB 2
HP Orifice	EPDM
Floats	SS AISI 304
Ferrule	SS
Isolating Valve	SG Iron D/F sluice valve with Cap; Resilient seated non - rising spindle as per IS 14846.

Valves shall be as per the BOQ specifications and shall be PN16 pressure rating. The location of valves shall be agreed with the Engineer.

The Contractor shall provide test certificates for materials, and properties shal1 be in accordance with relevant standards.

Before carrying out pipeline pressure testing the Contractor shall verify with the supplier of the air valves that the valves have the capacity to sustain the pipeline test pressures. In the event that they do not sustain the pressure, the valves shall be removed and the stubs off the pipeline shall be blanked off before pressure testing the pipeline.

Stubs for air valves shall be as specified and shall be fabricated to the required dimensions by the Contractor, who shall then fix them to the pipeline.

6.22.4. Pressure Reducing Valves

Pressure reducing valves (PRVs) shall be of the pressure compensated globe type, piston or diaphragm operated, complete with external hydraulic relay system and designed to reduce a variable inlet pressure to a predetermined constant outlet pressure at varying flows. The controlling pressure point shall either be at the valve or at a point in the distribution network some distance from the valve. Valves shall be drop tight under no flow conditions.

Valve operation shall be achieved by the interaction of the inlet pressure, outlet pressure and an intermediate pressure produced by a pilot valve or relay system acting on the upstream side of the main valve. The relay control system shall consist of a hydraulic relay unit, orifice and strainer block, control valves and interconnecting small bore piping. The relay valve shall be manufactured completely in 316 stainless steel, and shall consist of diaphragm, diaphragm guide, support piston, spindle, etc.

The orifice/strainer unit shall have a body and internals of stainless steel. The pressure setting control valves and control piping shall be constructed in 316 stainless steel. The valves shall be designed such that the hydraulic relay system can be inspected, maintained or replaced without isolating the supply. All necessary repairs to the valve shall be possible without removing the valve from the line.

The pressure setting shall be capable of being adjusted on site by the use of an adjustment screw to alter the compression of the spring. The opening and closing speeds shall also be field adjustable by adjusting the flow regulation screw. The valves shall be capable of being fully opened or fully closed by respective opening and closing of upstream and downstream ground cocks.

The valves shall be designed to provide the necessary loss of head and shall operate without hunting. The valve mechanism shall be piston operated, controlled from a servo diaphragm actuated by an adjustable spring balance relay comparing pressure generated across an integral orifice plate.

The valve shall be coated internally and externally with a fusion bonded epoxy coating system to 300 microns dry film thickness. The internal coating material shall be suitable for potable water use, the valve being provided with the necessary certification.

Nominal pressures will be PN 16 or higher pressures as otherwise indicated.

Body ends shall be flanged and drilled to BS 4504, PN 16 or for the higher operating pressure indicated.

Valve materials shall be as follows:

Body and cover -cast iron or ductile iron
Internal valve -316 stainless steel
Relay valve -316 stainless steel
Valve parts and fittings -316 stainless steel
Trims, ported guide and seating - gunmetal to BS 1400 LG2C
Diaphragm; seating on plunger -reinforced synthetic rubber
Loading spring (if employed) -spring steel
Cylinder weights (if employed) -cast iron or ductile iron
Indicating rod -316 stainless steel
Piston -316 stainless steel

Valves shall be factory tested, and supplied with a test certificate indicating the valve serial number and the set pressure.

7.22.5 Service Connection Valves

Service connection valves shall be precision moulded ball valves manufactured and tested in accordance with ISO:4422-4, and with threads in accordance with ISO-7, BS:21 or IS 554. Valves shall be manufactured from high quality PVC resin or ABS, and the valve body provided with threaded ends or compression couplings and adaptors to suit the service pipe and meter installation details. Wherever possible, the Contractor shall provide and install the valves within the existing meter chamber at the consumer premises or as directed by the Engineer.

Valves shall be PN16 rated, and be suitable for continuous contact with potable water up to 60° C.

7.23 Nuts, Bolts, Washers and Gaskets

Unless otherwise specified, nuts, bolts and washers shall be galvanised and/or zinc electroplated to conform to the requirements of IS 1364. Bolts shall be of sufficient length so that at least one thread but not more than three threads shall protrude through the nut when in the fully tightened condition.

All gaskets shall be manufactured from SBR rubber in accordance with IS 5382. The dimensions of flange gaskets shall comply with BS 4865.

7.24 Specifications for Consumer Meter Chambers

It should be properly located well clear of vehicular and pedestrian traffic and provide easy access to the meter and service connection valve for reading and maintenance. The chamber should preferably be located near the entrance inside the consumer property. The top of the meter chamber should be of slightly higher level than the ground to avoid entry of water inside the chamber.

The inside clear dimension of the meter chamber shall be 600mm x 450mm x 400mm depth. The construction of the chamber shall be of FRP installed on a well-compacted sand base. The cover of the chamber shall also be of FRP and provided with appropriate security and lifting arrangements. All edges and corners shall be finished smooth. A slot in the shape of an inverted U shall be provided on the short sides of the box section along its centreline for the passage of the pipe. The height of the slot shall be half the clear inside height of the box and the width shall be 60mm with a tolerance of +/- 3mm.

PART 5: UNACCOUNTED FOR WATER REDUCTION AND CONTROL

8.1 District Meter Areas

8.1.1 Design

The Contract area shall be divided into District Meter Areas (DMAs) particularly each service zone shall be considered as one DMA. However, the Contractor shall size the DMAs based on good industry practice, taking into account the water distribution system configuration, continuity of adequate supplies to all consumers, ease of establishment and maintenance. The contractor shall propose the actual number no. of House Service Connections coming under each DMA.

Divisional, sub-divisional and service area boundaries are not currently based on hydraulic boundaries but are defined purely for administrative purposes. For future technical operational reasons, the divisional, sub-divisional and service area administrative boundaries are to be progressively adjusted to coincide with the hydraulic boundaries of the

new DMAs as they are developed and implemented. This will require some areas of jurisdiction to be transferred between divisions and also between sub-divisions and service areas. DMAs will therefore be designed to take into account the following principles:

1 **Create hydraulically isolated Service Station Areas**. Each Service Station Area (or Water Supply Zone) will be supplied from a service reservoir or directly from a transmission or trunk main tapping, and will form a DMA.

2 **Number of connections within the DMA.** The size of a DMA is a compromise between the cost of establishing and operating the DMAs, and the reductions in UFW and leakage that can be achieved. After a DMA is established it is likely that the number of connections in it will increase due to the formalization of illegal connections and natural increases in consumer density within the DMA. However, the number of connections can be around 6000 to 7000 (approximate number of connections in one service station).

3 **Ease of creating hydraulic boundaries**. DMA boundaries will be based on existing topographical boundaries such as canals, railways, major roads, etc., as well as the ease of creating hydraulic boundaries within the existing distribution network considering the service station areas. This will minimize installation work (new/replacement valves, district meters, new cross-connections, etc.) and establishment costs, keeping changes to supply characteristics and disruption to existing consumers to a minimum, as well as reducing roadworks requirements, etc. Where it is beneficial for small modifications to be made to the contract boundary in order to benefit from supply patterns or to simplify/optimize hydraulic boundaries, adjustments may be made to the contract boundary following agreement with the Engineer’s., the E.E.’s and other Contractors in adjacent contract package areas, and subject to BWSSB approval in principle. No claims or extensions of time will be allowed for such contract boundary adjustments.

The Contractor shall develop a detailed method statement and specification for undertaking the design of the DMAs. This shall be reviewed and approved by the Engineer. Each DMA shall have around 2000 to 2500 connections for better monitoring of supply system.

Electronic water meters shall measure the DMA inflow and outflow, with pressure monitored by pressure transducers, and all flow and pressure data recorded by the integral loggers. The number of water meters shall be kept to a minimum commensurate with best practice.

The Contractor shall undertake a pipeline mapping survey to confirm the accuracy of the digitised distribution system record plans issued to him. Pipeline routes and diameter/material type, where access to the pipeline is possible, valve type and locations, and pipe connectivity shall be recorded on the issued record plans in accordance with the requirements for the DMA record plans specified below. This information will be entered by the Contractor onto the BWSSB GIS system. The Contractor shall develop a strategy to undertake pipeline mapping surveys, and shall submit it to the Engineer for review and approval. The Contractor shall also describe the extent to which such surveys will utilise trial holes, surface detection techniques, including ground probing radar, non-destructive testing, etc.

The detailed investigations shall provide a comprehensive overview of the operation and performance of the DMA, specifically to determine the extent and severity of any inadequate levels of service measured against the stated criteria for water quality, customer complaints, pressure, interruption to supply (pipe bursts) and leakage. Specifically, the performance of the DMA shall be assessed in the following areas:

- water quality – customer complaints and chemical water quality
- pressure
- future demand

If any part of the contract area is not covered by the existing GIS base maps, the Contractor will advise the Engineer who will request any missing base map data to be provided by the Employer at no cost. Where base map data is not available, the Contractor will input the necessary data into the GIS on a schematic basis with clear links provided to physical benchmarks. The contractor has to make his own arrangements for creating access to the web based GIS system created under D2b contract. Contractor will be responsible for any modification to the software/terminal/Others for this working, Updation and completion and being able to work with the data/information associated with the contract works independently for the contract area.

The contractor may also refer to other organisation such as BBMP, BDA, KPTCL etc., for road maps and the same may be used. BWSSB would help the contractor by providing necessary letter for coordinating with the other organisations. The responsibility of procuring the maps lies with the contractor.

If unknown mains are identified by the Contractor during the pipeline mapping survey, or during other work activities, and do not appear to be in

service, the Contractor shall investigate and test the mains in consultation with the Engineer to bring them back into service if it is DI mains. The Contractor shall up-date distribution system records and the BWSSB GIS, and incorporate the restored main into the network analysis and model.

The Contractor shall up-date the GIS system of BWSSB regularly throughout the contract period as details of the distribution network are verified during surveys, leaks are repaired, new pipes and fittings are installed or existing assets are replaced, and as pipe replacement proceeds. All findings and system asset changes shall be incorporated into the GIS system. The contractor has to make his own arrangements for creating access to the web based GIS system created under D2b contract. Contractor to be responsible for any modification to the software/terminal for this working, Updation and completion and being able to work with the data/information associated with the contract works independently for the contract area. At the end of the contract the terminal will be handed over to BWSSB.

Where illegal connections are identified during the mapping work, house to house surveys, or at any other time, the Contractor shall report the details to the Engineer for reporting to BWSSB for further action to formalise or disconnect the consumer. Prior to disconnection, the Contractor shall check for any alternative water supply to the property. If there is no apparent alternative supply, and the consumer has not applied for a legal connection within 3 months, the Contractor shall return and thoroughly investigate how the consumer is meeting his water demand following disconnection, and to check if there are other illegal connections supplying the property or if the consumer has re-connected illegally. The results of such investigations shall be reported regularly to BWSSB for further action.

Supplies to slum areas and all public stand posts are legal connections, with most stand posts being within slum areas. However, generally no payment is made for such water and practically none are now metered due to vandalism, cost, etc. All bulk supplies to slum areas shall be metered or flow shall be measured by using temporary flow meter for quantity assessment for UFW calculations. The contractor’s proposals shall be approved by the Engineer. The contractor shall be responsible for maintaining and repairing, and if necessary replacing, all such slum and stand post meter installations throughout the contract period.

The Contractor shall undertake house to house surveys to record the number of residents, all water supply sources on the premises, including alternative private supplies such as a borehole or well, in addition to legal and illegal connections, and shall report details of private supplies and illegal connections to BWSSB. As part of the survey, all consumer meters and meter chambers, as well as service pipes, shall be inspected for satisfactory operation and location, and checked against BWSSB records. As a part of works, all leaking and non-operating meters, 7-year-old meters shall be replaced with new meters of class B or better and meeting the relevant clauses of this Specification. The existing recently fixed Class-B meters by BWSSB shall be retained after verifying the same with BWSSB

data base. Where existing meters are installed incorrectly, or the meter chamber has poor access or is not clearly visible, the contractor shall replace the existing installation as approved by the Engineer.

The maintenance and accuracy testing of new meters procured and installed by the Contractor rests with the Contractor until completion of the contract period, irrespective of the date of meter installation. He shall replace all defective, leaky and non-operative meters with new meters at no cost.

Mains crossing the DMA boundary that are to be retained but their flows not measured shall have an isolating boundary valve installed. Mains crossing the DMA boundary that are not considered to be essential for maintaining flows between DMAs under emergency, or similar, conditions shall be linked inside the DMA to form pipe loops and the mains layout altered to avoid dead-ends, where practical, and to maintain hydraulic performance.

Circulating valves, i.e. those valves that are closed in order to remove all loops from within the DMA thus producing a tree-like mains layout, shall be identified and new valves installed where necessary.

On completion of the design the Contractor shall prepare the DMA Design Report in both hard and soft copies and submit it to the Engineer for approval.

All consumer revenue meters and DMA meters, together with their associated permanently installed pressure monitoring transducers, shall be procured under the contract. However, all other monitoring and all location and leak detection equipment shall be supplied, repaired/replaced, and maintained in good order by the Contractor who will retain ownership of them throughout the contract and shall remove them at the end of the contract Operation and Maintenance period. At least 6 months before the end of the contract the Contractor shall identify and agree with the Engineer what items of equipment the Employer needs to procure in order to continue monitoring the DMAs and to continue undertaking UFW and leakage control activities effectively in the completed DMAs. No items of the Contractor’s equipment shall be removed without the approval of the Engineer.

The Contractor shall provide, operate, repair/replace, and maintain in good order, all necessary monitoring and recording equipment required to undertake the contract efficiently, including all pipe and valve locators, temporary flow meters, pressure gauges, pressure/level transducers, data loggers and all leak detection equipment, etc. At the start of the contract, and before any fieldwork commences, the Contractor shall provide recent calibration certificates for all such equipment. Re-calibration certificates, as appropriate, shall be provided by the Contractor at no cost during the Contract as required by the Engineer.

When undertaking activities at night (such as surveys, step tests and leakage detection activities), the Contractor shall take special precautions to protect personnel from traffic and other hazards by providing protective

reflective jackets or vests, using temporary workmen warning road signs, providing adequate illumination, and having lookout personnel as needed.

8.1.2 Pressure Zero Tests

A Pressure Zero Test (PZT) shall be carried out in accordance with the procedure detailed in this clause in order to prove that the DMA can be isolated fully from the rest of the pressurised distribution system. PZTs shall not be undertaken when the DMA is isolated from the rest of the distribution system, e.g. as part of a water rationing schedule.

In order to undertake the Pressure Zero Tests sufficient pressure logging points shall be installed to verify that the mains pressure has dropped to zero across all parts of the DMA during the test. Suitable locations for pressure monitoring shall also be identified and installed to regularly monitor Average Zonal Pressure (AZP) and Critical Pressure Points (CPP) in each DMA. All AZP and CPP pressure points shall be permanently monitored at D2b/central SCADA server. The PZT procedure shall be as follows:

1. Any sensitive (e.g. hospitals or schools) or large consumers shall be identified and individually informed of the proposed PZT. A general warning shall be given to all other consumers in accordance with the Employer's procedures.

2. Valves isolating the DMA from the rest of the distribution system shall be confirmed operable prior to undertaking the PZT.

3. PZT's are to take place between 1.00am and 5.00am, or during an alternative suitable period when water is available.

4. Deploy pressure loggers on the pressure logging points and set to 5 minute intervals.

5. Shut the supply valve(s) and boundary valves in order to isolate the DMA.

6. The pressure on the loggers, as read on-site, should fall as soon as the supply and boundary valves are closed. If the pressure falls to zero excluding static head, or reduces but will remain steady for more than one hour, this will be accepted as a successful PZT.

7. If a successful PZT is not achieved, check and sound each supply and boundary valve in turn. Passing valves should be fully closed, where possible, and the PZT repeated.

8. If the PZT is not successful, the Contractor shall organize further investigations to find the cause of the failure and then repeat the PZT.

9. On successful completion of the PZT, open the supply valve(s) and confirm that supplies have been restored to their former level within the DMA. Loggers deployed under (4) above shall be left in place for 7 days after the completion of a successful PZT to confirm the impact of the new boundary on local pressures. Customer contact shall be monitored and reviewed over this period also and any necessary action to rectify supply

problems shall be taken by the Contractor in consultation with the Engineer.

10. Ensure all relevant records are completed before leaving site. Paper and electronic copies of the pressure data logging results shall be retained.

11. Prepare the PZT Completion Report in both hard and soft copies and submit to the Engineer.

12. Dial pressure gauges to also be installed during PZT.

All down loading of data form any logging equipment has to be done in the presence of engineer or may on the written permission of engineer. The printout be taken immediately and signed by engineer.

8.1.3 DMA Establishment

Following approval of the DMA Design Report by the Engineer, establishment of the DMA shall commence.

If consumers experience any water supply problems during the creation and proving of a DMA, or when operating DMA valves, the Contractor shall investigate the water supply problem immediately and make any adjustments to DMA design and implementation necessary to resolve it. Similarly, if the DMA boundary is breached, or boundary valves are operated by others, or the water supply regime is changed after DMA formation, the Contractor shall investigate and rectify such breaches. No claims or requests for extension of time will be considered for such investigations, remedial work or consequent delays. However, if the water supply regime is changed as a result of conversion of a gravity main to a pumped main to supply new developments in nearby areas, any physical work required will be eligible for payment under the work Schedule items in the Bill of Quantities, but no other claims or extensions of time will be considered.

All installation of pipelines, meters and ancillary works shall be carried out in accordance with the relevant clauses of this Specification.

During installation works pipe sections removed shall be bagged, tagged and sent for analysis in order to provide additional data for pipe condition assessment.

Close liaison with BWSSB staff is essential when undertaking any operations on live mains. Arrangements for communications shall be agreed and documented prior to any such operations commencing.

8.1.4 Modifying DMA Boundaries

DMA boundaries may only be modified, or DMAs combined or sub-divided, with the approval of the Engineer.

The Contractor shall prepare a DMA record plan showing:

- Limit of the DMA
- Names of all roads in which mains are laid
- Diameter and material type for each main
- Locations and sizes of flowmeters
- Locations of all valves, with boundary isolating valves, circulating and step-test valves clearly indicated, numbered and marked clockwise or anti-clockwise closing
- Valve operating schedule for step-testing
- Total number of domestic and non-domestic consumers (all consumers shall be metered) in the DMA and in each step-test area
- Location of any metered consumers that use large quantities of water in relation to the rest of the DMA or use high flow rates at specific times of the day or week
- Location of all public stand posts

The Contractor shall also provide an Operating and Maintenance (O&M) Manual that details a specification and describes operation and maintenance information for all equipment installed under the Contract, together with the procedures for UFW and leakage reduction and control in each DMA. For each DMA there will also be a DMA File recording the historical development of the DMA, its features, results achieved, flows and leakage levels, trends, etc. The DMA Files shall be up-dated regularly as work is undertaken in each DMA.

All record plans and the O&M Manual shall be prepared in electronic format using the specified software and copied to CD. Paper copies of the record plans shall be A1 size. Five copies (paper) and two digital on CD of each DMA shall be issued to the Engineer.

A laminated copy of the DMA record plan shall be installed in each DMA meter electronic display unit enclosure for that DMA.

8.2 Unaccounted for Water Assessment

UFW is widely reported in percentage terms. However, the UFW for each DMA should be expressed as follows:

Initial % UFW = $\frac{X - (A + B + C + D)}{X}$ x 100 %, X Where:

X = Water input to the system (DMA) during the period (typically 1 month)
A = Water billed during the period
B = Water legally supplied but not billed (including slum and stand post consumption) during the period
C = Operational use (scouring, jetting, dust suppression, etc.) during the period

D = Tankers metered and billed/unbilled during the period

Note: The contractor can make use of the consumer meters/bulk meter if already installed for stand posts and slums.

After completion of the DMA, the Contractor shall determine the initial UFW level in each DMA. After establishing the initial UFW level, the Contractor is required to execute the physical works involving the replacement of all PVC, AC, PSC and pipes less than 100mm in diameter, all lead joint pipelines along with the house service connections associated with the replacing mains in each DMA

The performance of the contractor in reducing and maintaining UFW level at 10% will be evaluated during defect liability period .

Initial UFW

A suggested step-by-step process to evaluate the initial level of UFW is detailed below to illustrate the process envisaged, but the Contractor will be responsible for developing his own methodology to the approval of the Engineer.

1 Undertake pipeline mapping, location and interconnectivity surveys, and house connection survey.
2 Design DMA
3 Establish DMA boundary
4 Boundary confirmation.
5 Measure flow into the system (using temporary flow meters)
6 Assess consumption based on past consumption details provided by the Engineer.
7 Account for bulk supplies to slum areas, stand posts and others consumption ie water legally supplied but not billed.
8 Calculate initial UFW (in terms of volume of water measured into the DMA against that consumed as a %).

The Contractor shall take over responsibility from BWSSB for all UFW control activities, including leak location and repair, in the DMA from the date of commencement of work.

Even though BWSSB is operating the water distribution system, the Contractor is still fully responsible for his completed work and any remedy/rectification (including leak arrest) required during the defects liability period at his own expenses. The Contractor will have to demonstrate and substantiate if his completed work had been disturbed and/or damaged by others for any claim.

The contractor shall also measure and record the average hours of supply/day to each DMA, as well as the Average Zonal Pressure (AZP) for each DMA, with average supply hours/day and AZP measured every month

to monitor increases in supply hours and pressure service levels. As well as identifying improvement trends. The Contractor shall report his findings along with his proposed action plan to reduce the non-leakage components of UFW to acceptable levels. Pressure correction shall not be considered while calculating the UFW.

The Contractor is responsible for taking joint meter reading along with BWSSB meter readers or use consumer revenue meter records from the BWSSB meter reading section, subject to any periodic and random checking that the contractor feels is appropriate, for UFW assessment. The contractor shall submit the findings to the Engineers for review and appropriate actions. No payment will be made for any meter reading costs incurred by the contractor, all such costs being deemed to be covered in other rates.

For each DMA, the Contractor shall monitor the level of UFW regularly. The overall level of UFW shall be assessed regularly and reported together with the monitoring data and trend analysis in the monthly UFW, Leakage Reduction and Control Progress Reports.

The Contractor shall investigate and rectify any contamination reported in the DMA when once the DMA. The Contractor shall take any necessary steps to remove all contaminated water, disinfect any affected mains or pipework, and test the water for acceptable quality, as agreed with the Engineer. The payment for execution of any physical works related to arrest of contamination will be paid as per rates quoted under Schedule-2 and specials used.

8.3.2 Target UFW Levels

The contractor shall carry out pipe replacement, leak detection, repair of leak, accounting of non-leak component until the UFW level has achieve 10%. Once the achieved target UFW level of 10% is accepted for the DMA, it is the responsibility of the contractor to maintain the same and never let it fall below the target UFW level.

The contractor can use the latest technology / facility available for identifying details of underground utilities and leakage detection from water pipes.

8.3.3 Pressure Control

It is envisaged that little scope will be found for pressure reduction and control within the distribution system. However, during the course of his investigations, if the Contractor finds scope for reducing pressures then this should be evaluated and proposals developed for implementing such pressure reduction schemes. As pressure reduction will reduce leakage prior to any leakage detection and repair work being undertaken, it is usually found to be cost-effective to implement such schemes as a priority measure. As part of his proposals, the contractor should identify the details of the pressure reduction scheme, its costs and the potential savings in terms of reduced leakage. Target leakage levels referred to in Section 8.3.2 above should take account of the impact of any pressure reduction

schemes proposed.

8.4 Leak Detection and Repair

After determining Initial UFW levels, replacement of pipeline, the Contractor shall undertake leak detection and repair activities until achievement of the target UFW level by repeating the leakage evaluation procedures carried out to determine the baseline leakage.

Visible leaks identified at any time during the contract period till replacement of lead joint pipeline shall be taken up by the contractor. Payment for leaks arrested till the completion of replacement will be paid as per BOQ. This is essential to minimise complaints from the public and improve water availability. Any leaks repaired for the pipes covered under defect liability period will not be paid. Also, the leaks repaired that are subsequently found to leaking will be repaired at the cost of the contractor.

The location of all leaks repaired shall be entered by the Contractor onto the BWSSB GIS system.

8.5 Monitoring and Control of Leakage and UFW Levels during Defect Liability Period

The Defect liability period for each DMA will start after 36 months from the date of commencement of contract. It is the responsibility of the contractor to plan the activities to reduce the UFW in all DMA within the contract area in the 3-year contractual Design and Construction Period. The start date of the Defect liability period will therefore be after the completion date of design and construction period. During the Defect liability period the contractor maintains the achieved UFW level (i.e. 10%) at the end of the design and construction period or further reduces to the extent possible.

The performance of the contractor cannot be less than final values attained during design and construction period. It is presumed that all capital works required would have been executed during design and construction period. Any leaks in newly laid pipeline shall be taken up by the Contractor free of cost during DLP.

Illegal connections

- Wherever illegal connections are identified, the Contractor shall immediately report to the Engineer with details. The Engineer in turn will inform to the concerned BWSSB maintenance Engineer to formalize or disconnect the connection.

Water Quality Monitoring and Testing

- Water samples shall be taken after pipe replacement and commissioning made
  by the contractor at each locality or area.
- Water quality tests shall be conducted for physical, chemical and

biological
parameters as per the standards.
- The test results should be within the permissible limits. If otherwise, the Contractor to immediately necessitate action as per the approved water quality management plan and to stabilize the water quality to a satisfactory level if he is responsible for the quality deterioration.

Maintenance of Instrumentation System, DMA meters inclusive of associated accessories.

- Periodic device inspection. calibration, preventive maintenance, repair/replace, testing of all installed equipment inclusive of accessories
- To execute maintenance service contracts for the instrumentation system and wireless communication system together with testing and/or calibration.
- DMA meters, Flow & pressure transmitters, Electronic Systems, Software Maintenance and Patching, etc. Contractor to undertake preventative maintenance, testing, calibration, repair/replace etc.
- Inspect Wire, Cable and Connections etc.
- Replacement and/or repair of batteries, faulty sets and all other non-functional equipment to ensure trouble free communication
- Contractor to submit for approval his proposed maintenance management plan for all associated equipment.
- The Contractor is reminded that he is fully responsible for his installed works executed during the Construction stage.
- The Contractor will need to demonstrate and substantiate if the installed works had been disturbed and/or damaged by Others for any claim towards replacement and/or rectification.

The performance of the contractor in reducing UFW will be evaluated at the end of the contract.

8.5.1 UFW Levels

As soon as the target UFW level in each DMA is achieved, the Contractor shall monitor the level of UFW in the DMA. Monitoring frequency shall be twelve (12) times per year in each DMA. The monitoring results shall be reported. The Contractor shall inspect the DMA and take the necessary action to bring the UFW level down to the target or reduced level. Monitoring and active control of each DMA shall continue throughout the Maintenance Period.

The impact on the target UFW level in a DMA from any actual long-term

variation in DMA pressure levels as a result of reduced leakage, pipeline rehabilitation, changed hours of supply or operational practices, etc., shall be assessed by the Contractor.

The Contractor shall develop a detailed method statement and specification for monitoring and controlling the level of UFW. This shall be reviewed and approved by the Engineer. Irrespective of maintaining the target UFW level, all visual leaks appearing shall be repaired immediately wherever pipelines are laid by the contractor at free of cost and in places wherever contractor has not taken up any pipeline replacement work, the leak repaired shall be paid for under the relevant item in the Bill of Quantities for leak repairs. Visual leaks are those visible to the naked eye on the ground surface without undertaking any leak location investigation and may appear as ponded surface water or wet patches that have no apparent alternative cause other than a water leak. Water does not necessarily have to be bubbling from the ground to be classified as a visible leak.

8.6 Cost Benefit Analysis

On completion of all DMAs and measurement of initial UFW the Contractor shall undertake an interim cost benefit analysis to determine the anticipated financial benefit of the project. The analysis shall be comprehensive and in accordance with best international practice and shall report the projected cost of implementing the district metering leakage reduction and control policy and the value of water saved. Analysis shall be carried out for the project area and for each DMA.

On achieving the target UFW level in a DMA the final cost benefit analysis shall be repeated utilising known costs and leakage reductions achieved. The final project area cost benefit analysis shall be carried out once the target UFW levels have been achieved in all DMAs.

The impact of the distribution mains improvement on leakage levels and corresponding costs shall be reported, and taken into account in the analyses.

The Contractor shall develop a detailed method statement and specification for undertaking the cost benefit analyses. This shall be reviewed and approved by the Engineer.

8.7 Training of BWSSB Staff

The Contractor shall deliver appropriate and sufficient training to BWSSB staff so that the Board staff shall be capable of undertaking all activities involved in planning and undertaking UFW reduction and control. The training shall be a mix of on-the-job and local classroom training and shall cover, but not be limited to, the following topics:

- Overview of UFW reduction and control (including pressure management as a leakage control tool, recognizing that scope for its use may be

limited at present
in Bangalore)

- Design of District Meter Areas
- Computer network modelling
- Planning of PZT and implementation
- Planning of reduction of UFW and leakage level.
- Difficulties encountered while reducing UFW and leakage level
- Pipe and cable location
- Datalogging
- Leak correlation
- Acoustic leak sounding techniques
- Step testing
- Leak noise loggers
- Water meters – DMA, bulk and revenue meters including testing and repair
- Leak repair techniques and materials
- Quality control
- Use of GIS and updation of information
- Operation and maintenance of the INSTRUMENTATION system and all installed equipment

For selected BWSSB staff directly involved in UFW activities, study visits to leading Indian water utilities or private water networks, as well as regional water utilities, where UFW control and distribution network rehabilitation has been successfully implemented may be included in the training programme.

A Training Report in both hard and soft copies shall be prepared by the Contractor describing the training delivered.

The Contractor shall develop a detailed Training Plan. This shall be reviewed and approved by the Engineer.

8.8 Reporting

The following reports (draft and final) in both hard and soft copies shall be prepared by the Contractor for each DMA:

(a) Design Report - detailing the design parameters used, network model constructed, physical works proposed including cost estimate, etc.
(b) PZT Completion Report - detailing the operations undertaken to complete the PZT and the results recorded.
(c) UFW, Leakage Reduction & Control Progress Report – monthly report (final version only) describing the UFW and leakage measurement, detection and repair activities undertaken, including a summary for the full project area.
(d) Cost Benefit Analyses Reports – interim and final analyses as detailed above.
(e) Training Report (single project report)
(f) Final Project Report describing all activities undertaken and results achieved.

Five copies of each report shall be issued in hard copy and two in soft copy to the Engineer.

Notwithstanding the above reporting requirements, the Contractor shall allow the Engineer and the Divisional Executive Engineer (E.E.) of BWSSB access to all data, including metering data, at any time. Data shall be provided in soft copy as requested.

8.9 Quality Control

An audit trail shall be identified for all UFW reduction and control data such that these can be validated. Prior to commencing the UFW reduction and control programme the Contractor shall submit his Quality Plan to the Engineer for approval. The Quality Plan shall demonstrate that the Contractor has in place robust audit trails to ensure satisfactory auditability by the Engineer and the Employer.

8.10 Program for Field Activity

Contractor has to submit his field activity program to the Engineer at least 24 hour before start of the activity. The detailed program may be communicated through a hard copy along with e-mail or fax.

8.11 Contract Milestones

The Contractor is required to complete the initial UFW level, replacement works and achieve targeted UFW as per target and Milestones as mentioned in CONTRACT DATA.

Unless the Contractor can demonstrate and substantiate the causes of delay for not being able to meet the milestone dateline, payment may be withheld from the day after the milestone date. Withheld payment may be released when the Contractor completes all the works associated with the milestone work.

End of Part 5

SPECIFICATION
PART 6
DMA FILE

9.1 Purpose

This document identifies the processes and procedures required for compiling the District Meter Area (DMA) File which describes the design and establishment of the DMA, leakage detection, repair and monitoring, on-going operation & maintenance and, where appropriate, pressure management. Every DMA shall have a DMA File to serve as a reference document describing the above activities within the DMA. The DMA Files, together with the Operating and Maintenance Manual, constitute the Operating and Maintenance manual system.
Documents that form part of the DMA File are detailed in the Specification. The DMA Files provide BWSSB with a comprehensive document that describes DMA design, establishment and operation & maintenance. One copy of each DMA File should be made the Master document that is continuously up-dated to reflect the status and achievements reached in the DMA. The Master DMA Files are therefore live documents continually being up-dated.

9.2 Scope and Responsibility

9.2.1 Scope

This procedure shall be applicable for use by staff with responsibility for DMA implementation, leakage management and pressure management.

10 Responsibility

The Contractor’s Representative shall be responsible for maintaining the working practices and records detailed in this procedure.

The Engineer, or his designated representative, is responsible for ensuring compliance with the working practices and records detailed in this procedure.

11 Health and Safety

Permission to proceed must be obtained prior to undertaking any work on the distribution system as per specifications.
A risk assessment will be carried out by the Contractor in liaison with the BWSSB local Operations staff to minimize customer impact. Particular reference should be made to minimizing the risk of dirty water incidents and avoiding unnecessary disruption to Key and Sensitive Customers.

All work will be undertaken in accordance with the Specification.

12 Procedure

12.1.1 Introduction

This document provides guidance to BWSSB, and contractors and consultants working on their behalf, who are in the process of designing and implementing new DMAs, undertaking mains improvement and reviewing the current water distribution system. The aim is to improve distribution system performance monitoring and to enable BWSSB operational staff to manage their system efficiently in the future.

The technique of performance monitoring requires the installation of flowmeters at strategic points throughout the distribution system, each meter location recording pressures and flows into (and out of, where appropriate) a discrete district that has a defined and permanent boundary. Such a district is called a District Meter Area (DMA).
Performance monitoring has a number of aims:

- To divide the distribution network into DMAs with a number of DMAs making-up a Water Supply Zone (WSZ), each with a defined and permanent boundary so that night flows into each district can be regularly monitored. It is envisaged that WSZs will be based on reservoir service station areas in the project area;
- To enable the presence of unreported bursts and leakage to be identified, located and repaired;
- To manage the demand and pressures in each DMA or WSZ so that the optimum level of pressure and levels of service (LOS) to BWSSB customers are maintained;
- To facilitate Contingency Planning;

It therefore follows that a performance monitoring system will comprise a number of districts where flow is measured by permanently installed flowmeters.

This document defines the processes and procedures required for DMA design and implementation, UFW/leakage assessment and reduction, and routine monitoring.

12.1.2 Data Feedback to BWSSB

It is essential that at all stages of DMA planning, design and establishment an accurate record of all investigations and works carried out is maintained. Standard forms should be prepared to assist in compiling records and these should exist in both paper and electronic formats. Copies of the electronic media should be handed over to BWSSB to update their corporate systems.

Updating of records on the BWSSB GIS system will be managed by the GIS section, but it will be the responsibility of the Contractor to input the new data and undertake this work for the project boundary.

12.2.3 *Permission to Proceed*

Before any work shall be undertaken by the Contractor, permission to proceed in accordance to the Specification shall be issued by the Engineer, or his designated representative. No planned work shall be carried out on any BWSSB asset without such permission. The written permission to proceed shall be used as an historical record of all working activities carried out on BWSSB's assets.

The Contractor shall be responsible for all liaisons required by BWSSB. Possession of a current written permission to proceed shall not relieve the Contractor from his obligations under the Specification (safety and security on site).

12.2.4 Strategy Study

The objective of this study shall be to report the existing arrangements within the WSZ and outline the proposals for establishing DMAs.

On completion, the DMA Strategy Study Report shall be agreed with the Engineer, following which detailed design of the DMAs will commence. This study report (a short, concise report is envisaged) and its agreement with the Engineer encourages a step-by-step approach to developing the Contractor's proposals through regular dialogue with the Engineer.

13.1.1 DMA Design

The DMA design shall be described in the DMA Design Report (refer to Appendix A for report contents).
The detailed design of DMAs will include:

- Detailed investigations and design of works to establish DMAs in the areas outlined in the Strategy Study Report;
- Works Installation Packs (refer to Appendix B for details) identifying the proposed DMA establishment works, site information and potential construction constraints;
- Assessment of Average Zonal Pressures and Average Zonal Night Pressures for the DMAs. This shall be achieved by identification of the Average Zonal Point and logging pressure at this point for a minimum of seven days to ensure peak day consumption is recorded;
- Identification of key pressure monitoring points and the subsequent installation of appropriate monitoring equipment;
- Identification of DMAs that would benefit from pressure management, together with the design and installation of appropriate pressure reduction equipment;
- Condition assessment of existing mains and identification of mains for replacement programme.

Once the DMA design has been completed, the DMA Design Report shall be submitted to the Engineer for approval prior to commencing the DMA establishment works.
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13.1.2 Pipe Condition Assessment and Sampling Policy

Contractor to make sure that replacing mains are existing CI/PVC/PSC during construction (laying) works. In addition, if required, during meter and valve installation, etc., pipe sections removed shall be bagged, tagged and analyzed to provide data for system improvement wherever existing system is retained.

Investigative methods to be employed by the Contractor shall include, but not be limited to, collation and interpretation of historical sample data and complaints, pipe sampling results, computerised network modelling, pressure and flow surveys, and leakage surveys.

13.1.3 DMA Establishment Works

Ideally, all installation works and valving associated with the establishment of a zone boundary shall be completed in a single pass to keep disruption to customers to a minimum. In addition to any installation of new or replacement of BWSSB assets, it may be necessary to remove chambers and backfill disused fittings such as valves in order to prevent any confusion in the future over the location of operational/disused valves, etc.

On completion of the installation works and zone boundary establishment, the DMA flowmeters shall be commissioned and the proper operation of the DMA shall proved as per the DMA design report.

13.1.4 DMA Proving

After installation of the flowmeters and all work associated with DMA establishment, the new DMA boundary shall be proved in accordance with the Pressure Zero Test (PZT) procedure described in the Specification.

13.1.5 Leak Detection and Repair

Following completion of the DMA Level 2 Report outlining the level of UFW in the DMA, and after agreement with the Engineer on the target level of UFW, leak detection and repair activities shall commence.

13.1.6 DMA Final Report

On completion of all the works and after achievement of target level of 10%, the Contractor shall prepare the DMA Final Report in both hard and soft copies. This report will:

- Confirm all initial, and current UFW data;
- Include revisions to “as-built” drawings;
- Report actual savings in leakage (volumetric and financial);

- Report leak detection and repair costs;
- Report results to date of the UFW non-leakage Action Plan.

Refer to Appendix C for details of the DMA Final Report.

Sections of this report will contribute to the post-evaluation of the benefits of UFW control (and control of UFW non-leakage components) and, as such, shall be included in the Cost Benefit Analysis.

Appendix A: DMA Design Report

A.1 Introduction

The following sections detail the standard contents of the DMA Design Report. Once the report has been completed it shall be forwarded to the Engineer for approval prior to commencing the DMA establishment works.

A.2 DMA Design Report Contents

A.2.1 Summary of Proposed DMA Data

Summarise and report on the following DMA data on the relevant standard report forms (forms to be prepared by the Contractor):

- Property counts;
- Mains diameter/lengths/material/age;
- Metered consumer categories and large consumers;
- Boundary and internal valve details;
- AZP details.

Comment on the expected performance of the DMA, making reference to the following operational issues raised during the course of the design and the network modelling undertaken to confirm the hydraulics of the design:

- Low pressure areas;
- Dirty water areas;
- Mains condition;
- Sensitive needs customers, eg. hospitals;
- Sensitive mains.

A.2.2 DMA Plan Information

The proposed DMA plan, with expected pressure contours and the following details:

- Details of pipeline work to be taken up
- Proposed flowmeters (DMA import/export);
- Proposed PRV’s;
- Hydrant locations and condition;
- Proposed link/reinforcement mains;

- All boundary valves;
- Internal valve status;
- Redundant assets to be abandoned/removed/buried;
- All points used for data logging.

A.2.3 Field Test Data

All data captured through field tests recorded on standard report forms (forms to be prepared by the Contractor), including all logging operations required for the purpose of network modelling, identification of poor pressure areas, and areas where further investigation for mains rehabilitation have been identified.

A.2.4 Scope for Pressure Reduction

The recorded minimum pressure at the target point will determine any scope for pressure reduction. Where there is scope, an evaluation of the benefits of pressure management will be undertaken, with the results included in the DMA Design Report. These will demonstrate:

- Volumetric savings;
- Cost savings;
- Payback period of any proposed capital works;
- Recommendations for pressure management.

A.2.5 Scope for Leakage Control

Based on information available, conduct an evaluation of the benefits of active leakage control and include the results in the DMA Design Report.

A.2.6 Proposed Works

Include in the report, in standard format, design details for:

- New flowmeters;
- New PRV's;
- New boundary and internal valves;
- New link/reinforcement mains.

These details will form the basis of the Works Installation Pack described in Appendix B.

Appendix B: Works Installation Pack

B.1 Introduction

The following sections detail the minimum documentation to be included in the Works Installation Pack for the proposed DMA establishment works.

B.2 Technical Details

The Works Installation Pack shall include:

- Location plan;

- Details of pipeline works to be taken up
- Layout plans and detailed drawings for physical works;
- Materials schedule;
- Details of proposed trial holes;

B.3 Safety and Service Details

The Works Installation Pack shall include:

- Utility plans;
- Highways/traffic management proposals;
- Private land entry details;
- Customer warning notice requirements;
- Construction hazards identified during the DMA design process;
- BWSSB Permit to Work.

Appendix C: DMA Final Report

C.1 Introduction

The following sections detail the standard contents of the DMA Final Report which will be the final DMA report.

C.2 DMA Final Report Contents

C.2.1 Baseline Data

DMA flowmeter flow profiles before and after pipeline laying and leak repairs are to be presented to illustrate the impact of leak repairs.

C.2.2 Leakage Savings and Costs

Based on the flow profiles, the actual savings (volumetric and financial) in leakage should be reported along with the cost of achieving the leakage reduction.

C.2.3 UFW Non-leakage Reduction

The results to date of the UFW non-leakage Action Plan are to be reported. If the results are interim then the DMA file shall be updated with the final results on completion of the Action Plan activities.

C.2.4 DMA Revisions

It must be ensured that any amendment to the DMA layout affecting the zone boundary and/or baseline data shall be recorded on a revised DMA record plan and relevant forms, and be actioned in accordance with BWSSB procedures to enable all BWSSB corporate systems to be updated.

The completed DMA Final Report shall be submitted to the Engineer and BWSSB prior to commencement of routine monitoring and control of leakage and UFW levels during defects liability period. All DMA Final

Reports must be submitted to the Engineer prior to commencement of the defects liability period.

Road Restoration

The road surface has to be restored to its original state as per MORTH and technical specification and as per the construction drawing.

End of Part 6

SECTION 8:

DRAWINGS

SECTION 9:

BILL OF QUANTITIES

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITT Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITT Clause 24.1 (b)]

SECTION 10:

FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [63]_Rupees_____ _____[in words], and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee][64] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.
We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.
Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

[63] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

[64] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

Contractor
Employer